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Ito et al.

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(54) **INKJET RECORDING APPARATUS**

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(22) Filed: **Mar. 29, 2013**

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(30) **Foreign Application Priority Data**

Apr. 24, 2012 (JP) 2012-098306

(51) **Int. Cl.**

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B41J 2/175	(2006.01)
B41J 11/42	(2006.01)
B41J 13/00	(2006.01)
B41J 3/60	(2006.01)
B41J 11/00	(2006.01)
B41J 11/06	(2006.01)

(52) **U.S. Cl.**
CPC ***B41J 2/17566*** (2013.01); ***B41J 3/60*** (2013.01); ***B41J 11/005*** (2013.01); ***B41J 11/006*** (2013.01); ***B41J 11/06*** (2013.01); ***B41J 11/42*** (2013.01); ***B41J 13/0009*** (2013.01)

(58) **Field of Classification Search**
CPC B41J 11/42; B41J 13/0009; B41J 11/0015; B41J 11/0055; B41J 2/2114; B41J 29/393; B41J 13/00
See application file for complete search history.

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Primary Examiner — Geoffrey Mruk
(74) *Attorney, Agent, or Firm* — Banner & Witcoff, Ltd.

(57) **ABSTRACT**

Conveyance of a sheet in an inkjet recording apparatus may be stopped under various conditions. In one example, a control device of the inkjet recording apparatus may stop conveyance on the sheet depending on the image to be formed in one or more portions of the sheet. Alternatively or additionally, conveyance may be stopped based on an amount of ink ejected or to be ejected onto a sheet, or portion thereof. The conveyance stoppage control may be used in conjunction with a corrugate mechanism in some arrangements.

26 Claims, 15 Drawing Sheets

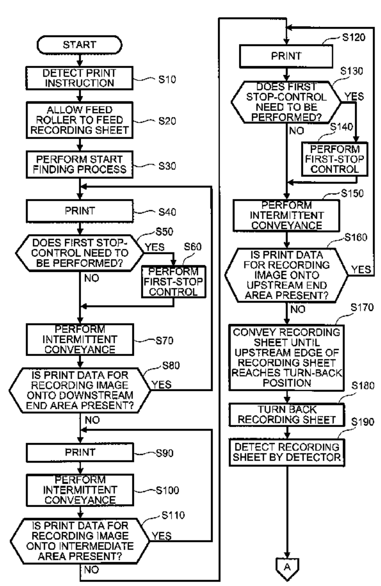
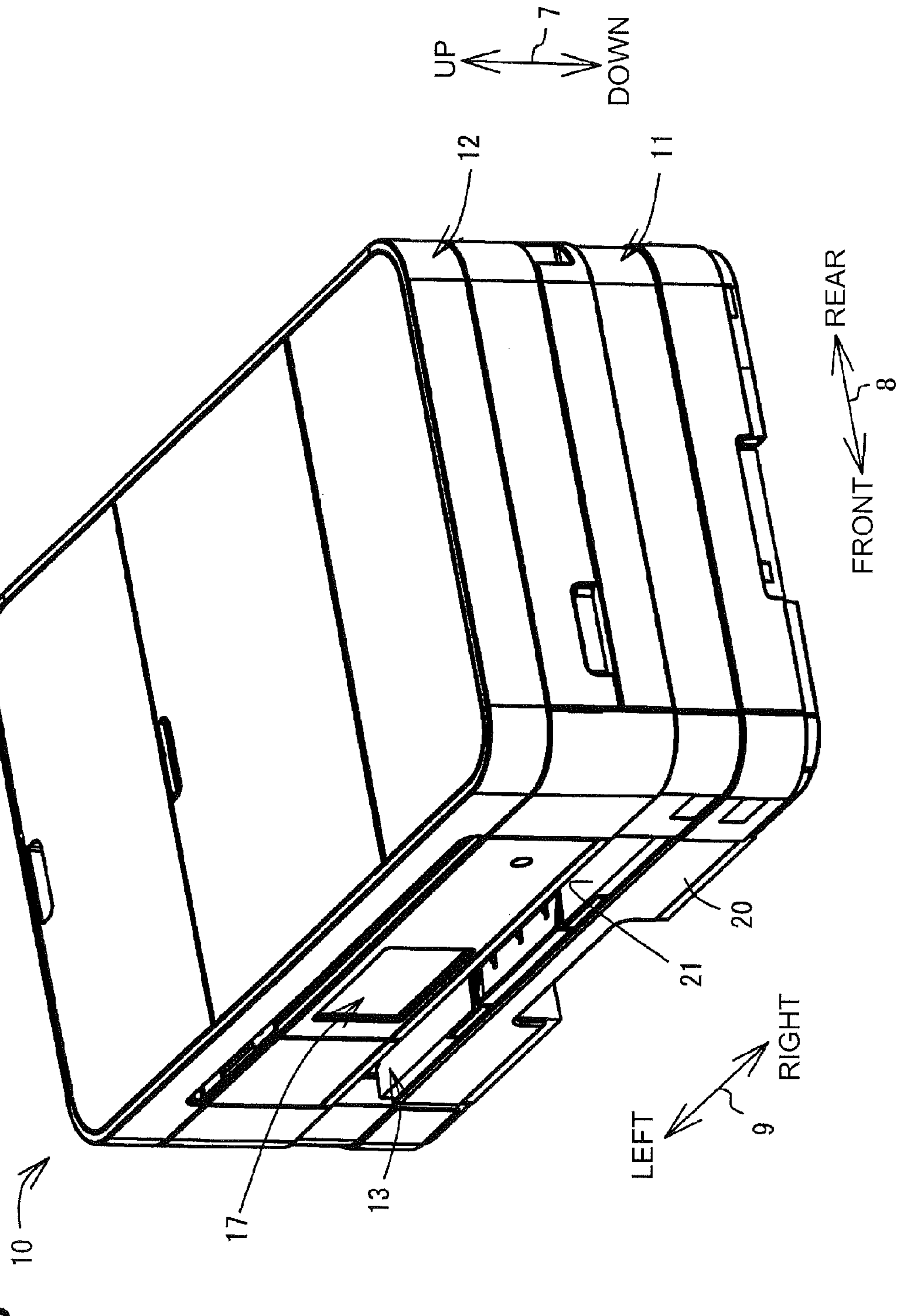
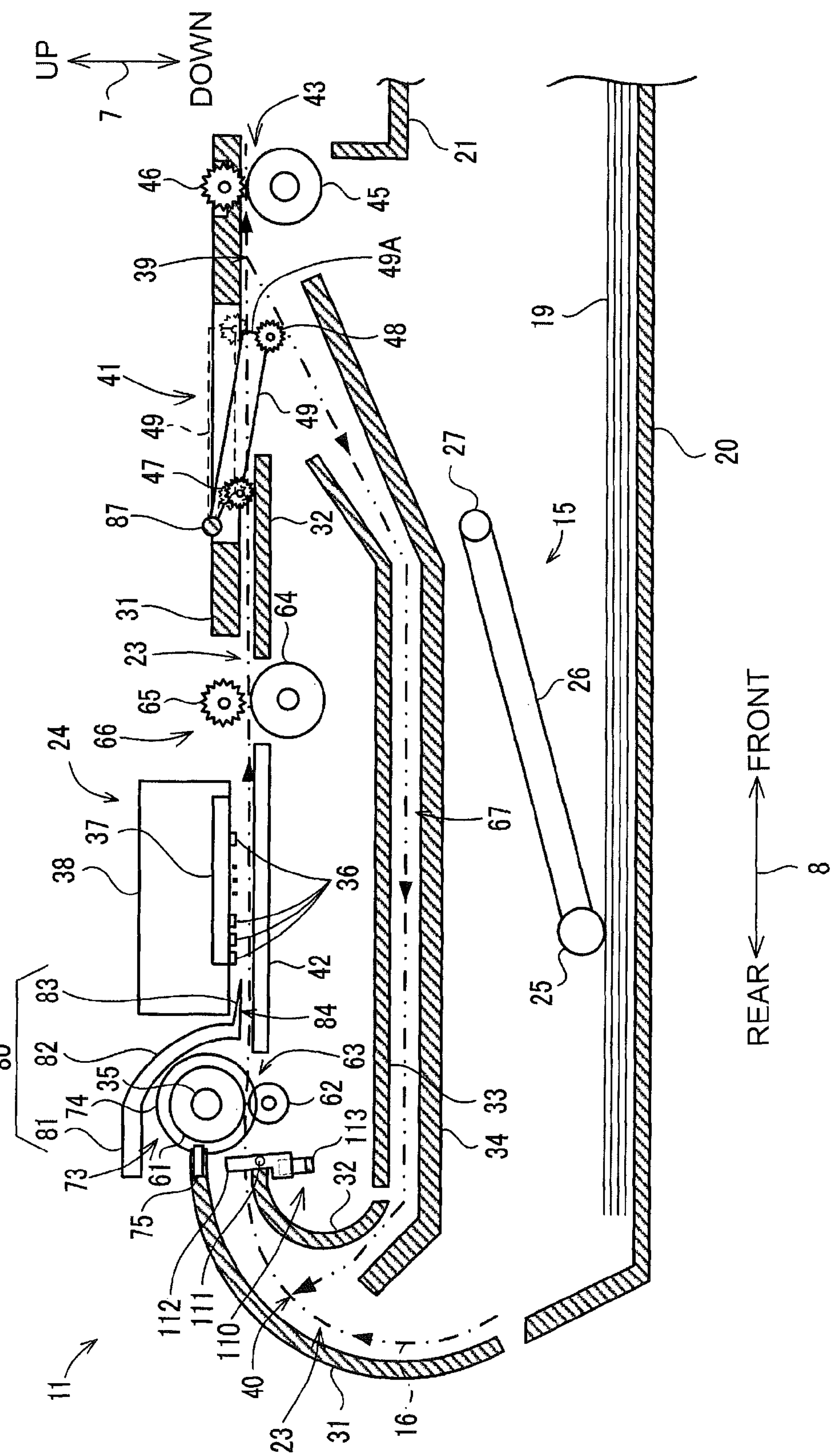


Fig.1




UP
DOWN
7
43
21
46
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39
49A
48
19
41
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49
27
20
47
87
32
15
31
64
23
26
65
66
24
67
FRONT
37
38
36
8
REAR
42
25
83
84
80
82
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62
33
74
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113
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73
61
32
75
112
111
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16
11

Fig.2

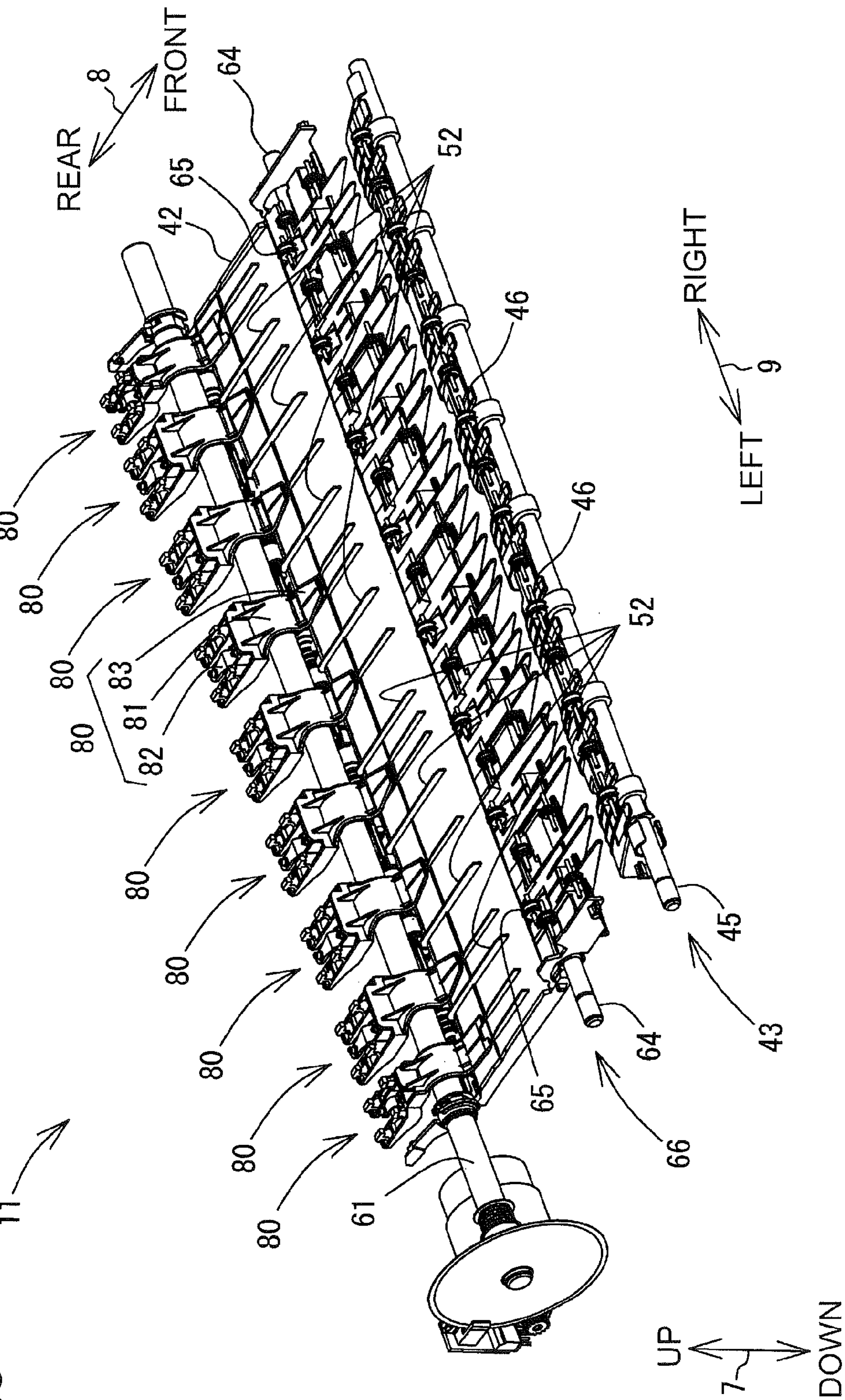
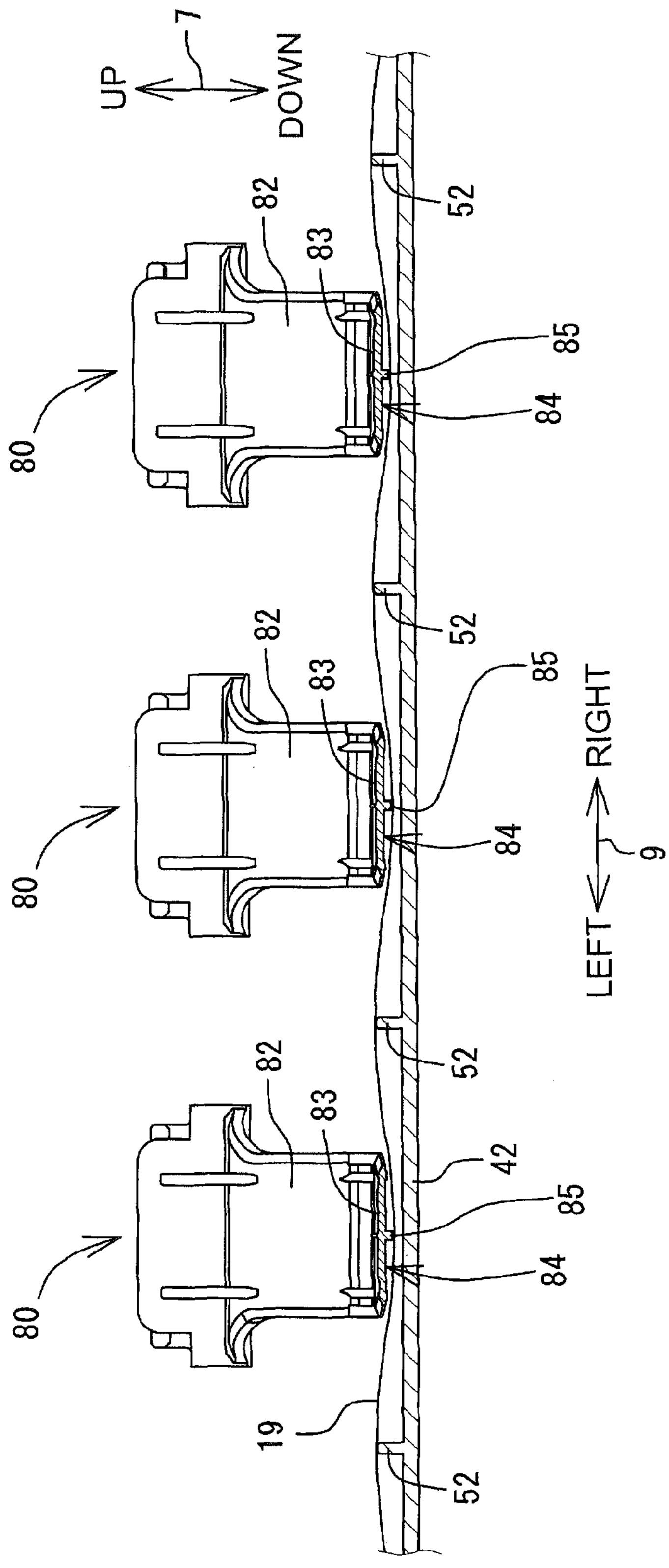

REAR
8
FRONT
64
65
42
52
RIGHT
46
9
LEFT
46
52
80
80
80
83
81
82
80
80
80
80
80
80
45
43
64
65
66
11
61
UP
7
DOWN

Fig.3

Fig.4



7
UP
DOWN
80
82
83
85
84
52
80
82
83
85
84
52
RIGHT
LEFT
9
80
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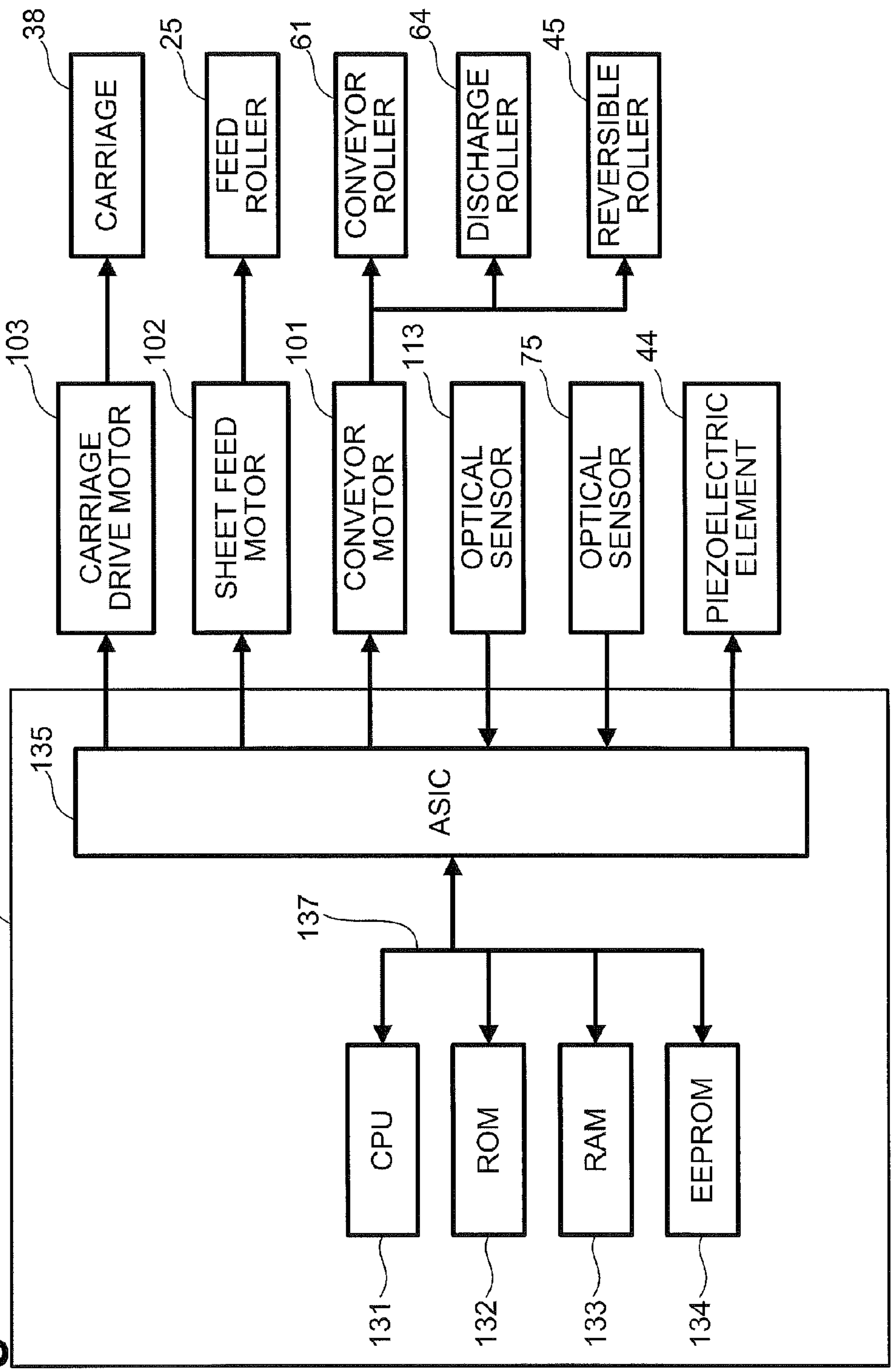
83
85
84
52
42
19
52

Fig.5



38
CARRIAGE
25
FEED ROLLER
61
CONVEYOR ROLLER
64
DISCHARGE ROLLER
45
REVERSIBLE ROLLER
103
CARRIAGE DRIVE MOTOR
102
SHEET FEED MOTOR
101
CONVEYOR MOTOR
113
OPTICAL SENSOR
75
OPTICAL SENSOR
44
PIEZOELECTRIC ELEMENT
130
135
ASIC
137
CPU
ROM
RAM
EEPROM
131
132
133
134

Fig.6

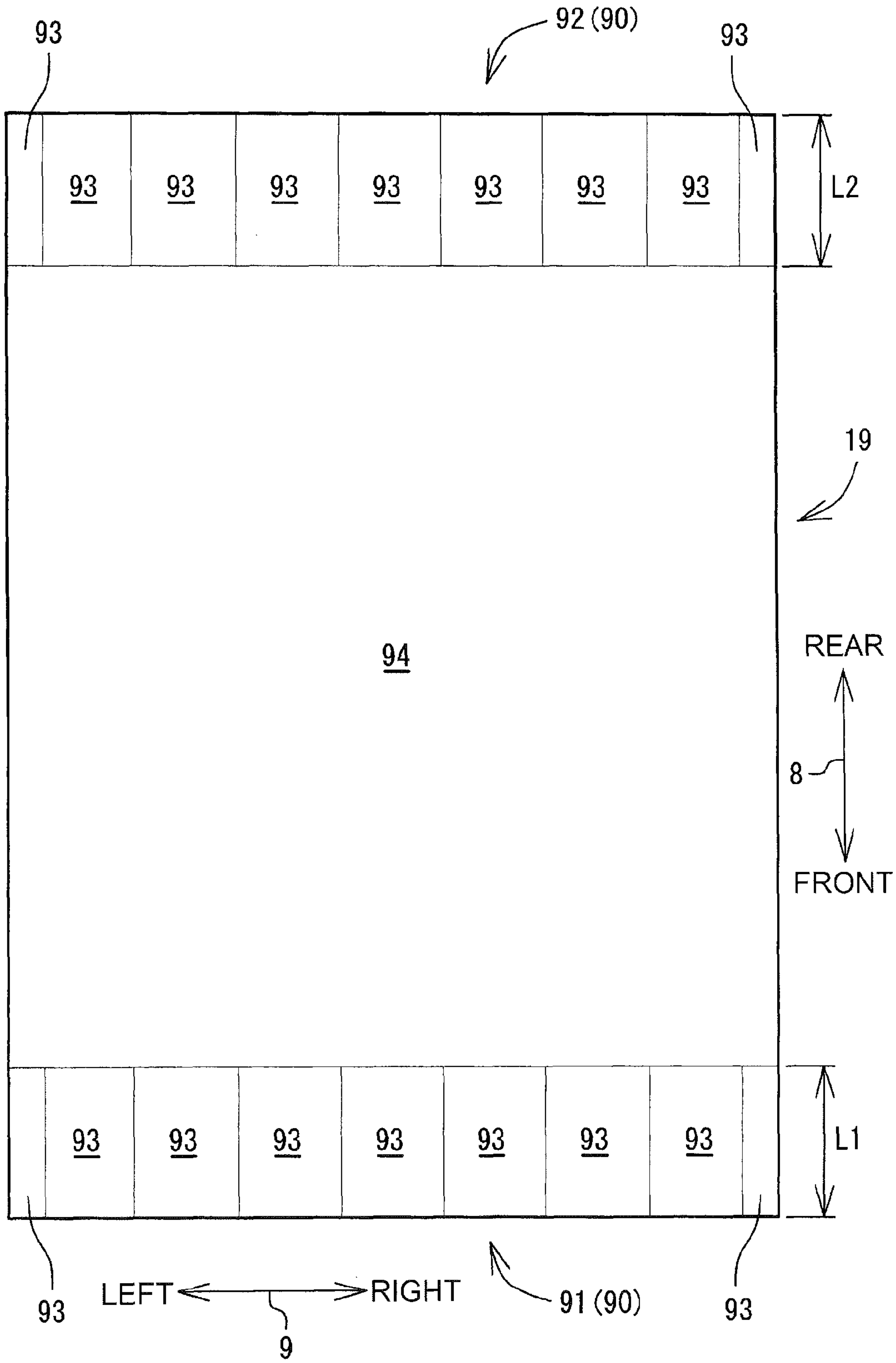

92 (90)
93
93
93
93
93
93
93
93
93
L2
19
94
REAR
8
FRONT
93
93
93
93
93
93
93
L1
93
LEFT
RIGHT
9
91 (90)
93

Fig.7A

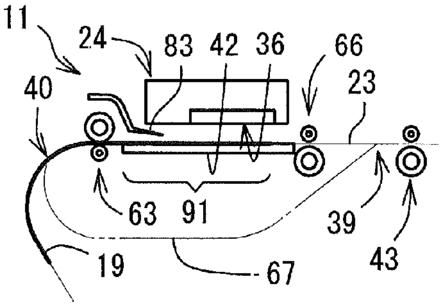


Fig.7B

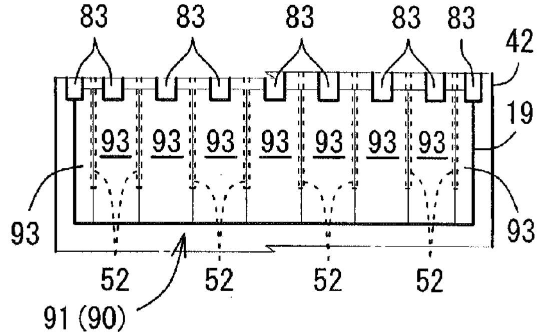


Fig.7C

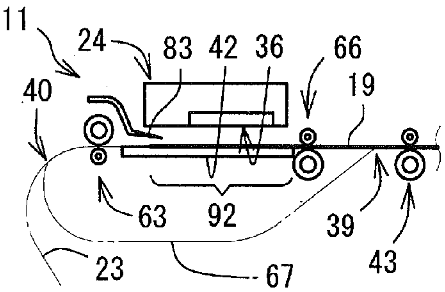


Fig.7D

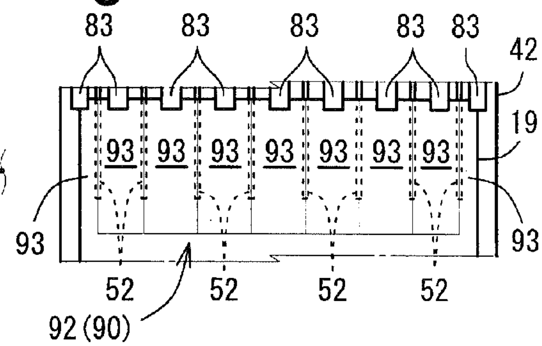


Fig.7E

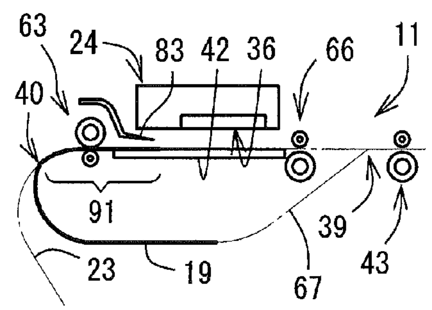


Fig.7F

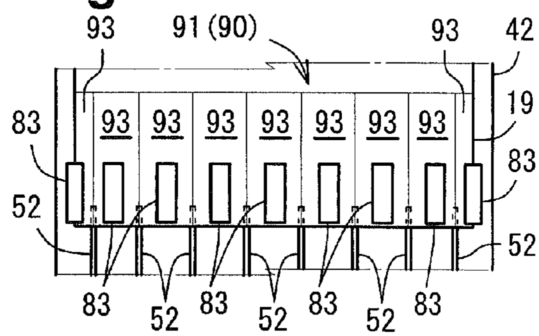


Fig.7G

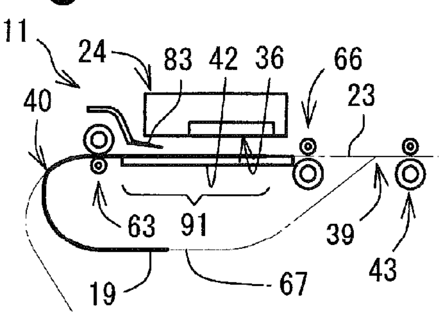


Fig.7H

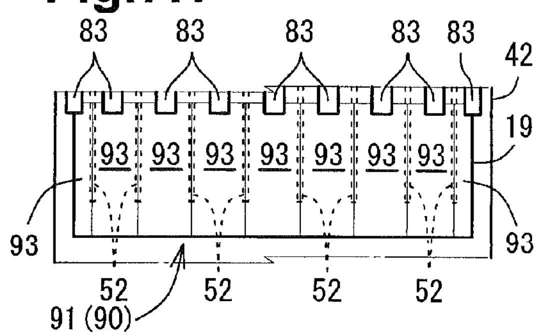


Fig.8A

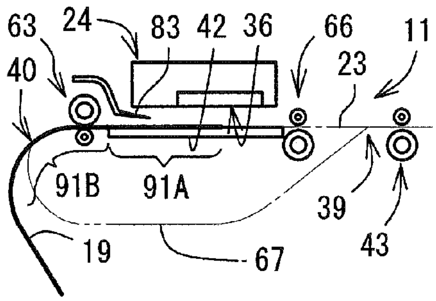


Fig.8B

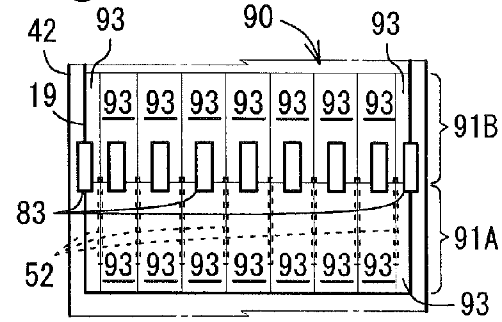


Fig.8C

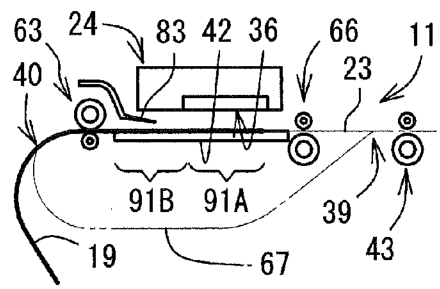


Fig.8D

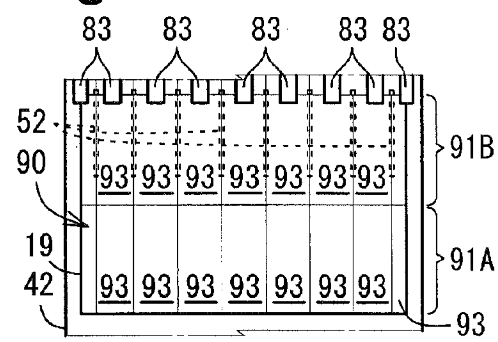


Fig.8E

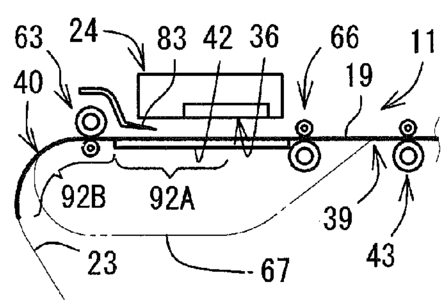
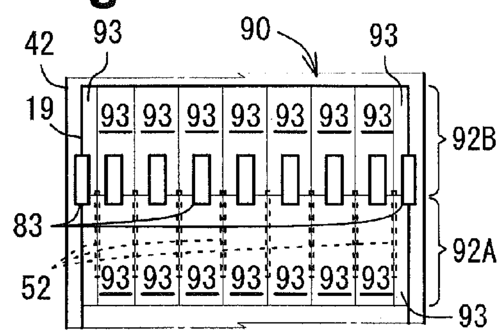


Fig.8F



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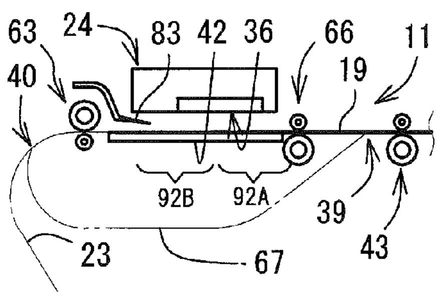


Fig.8H

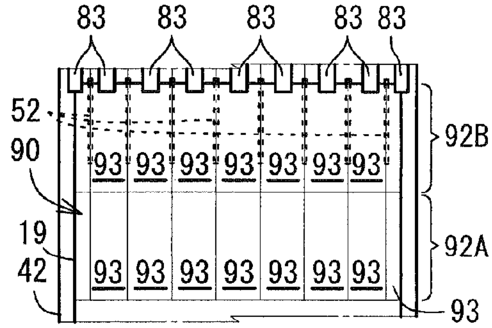


Fig.9

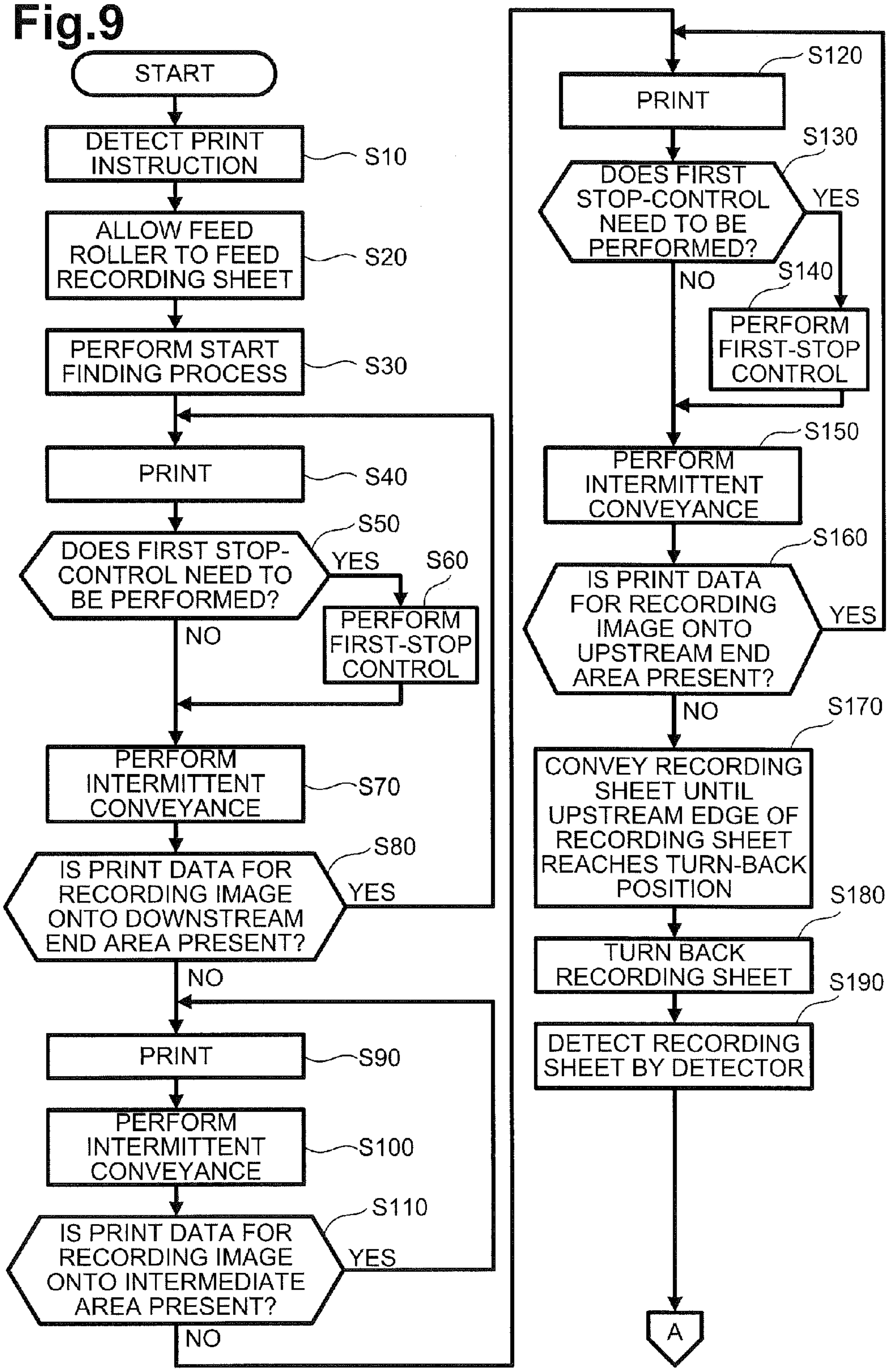

START
DETECT PRINT INSTRUCTION
S10
ALLOW FEED ROLLER TO FEED RECORDING SHEET
S20
PERFORM START FINDING PROCESS
S30
PRINT
S40
DOES FIRST STOP-CONTROL NEED TO BE PERFORMED?
S50
YES
NO
PERFORM FIRST-STOP CONTROL
S60
PERFORM INTERMITTENT CONVEYANCE
S70
IS PRINT DATA FOR RECORDING IMAGE ONTO DOWNSTREAM END AREA PRESENT?
S80
YES
NO
PRINT
S90
PERFORM INTERMITTENT CONVEYANCE
S100
IS PRINT DATA FOR RECORDING IMAGE ONTO INTERMEDIATE AREA PRESENT?
S110
YES
NO
PRINT
S120
DOES FIRST STOP-CONTROL NEED TO BE PERFORMED?
S130
YES
NO
PERFORM FIRST-STOP CONTROL
S140
PERFORM INTERMITTENT CONVEYANCE
S150
IS PRINT DATA FOR RECORDING IMAGE ONTO UPSTREAM END AREA PRESENT?
S160
YES
NO
CONVEY RECORDING SHEET UNTIL UPSTREAM EDGE OF RECORDING SHEET REACHES TURN-BACK POSITION
S170
TURN BACK RECORDING SHEET
S180
DETECT RECORDING SHEET BY DETECTOR
S190
A

Fig.10

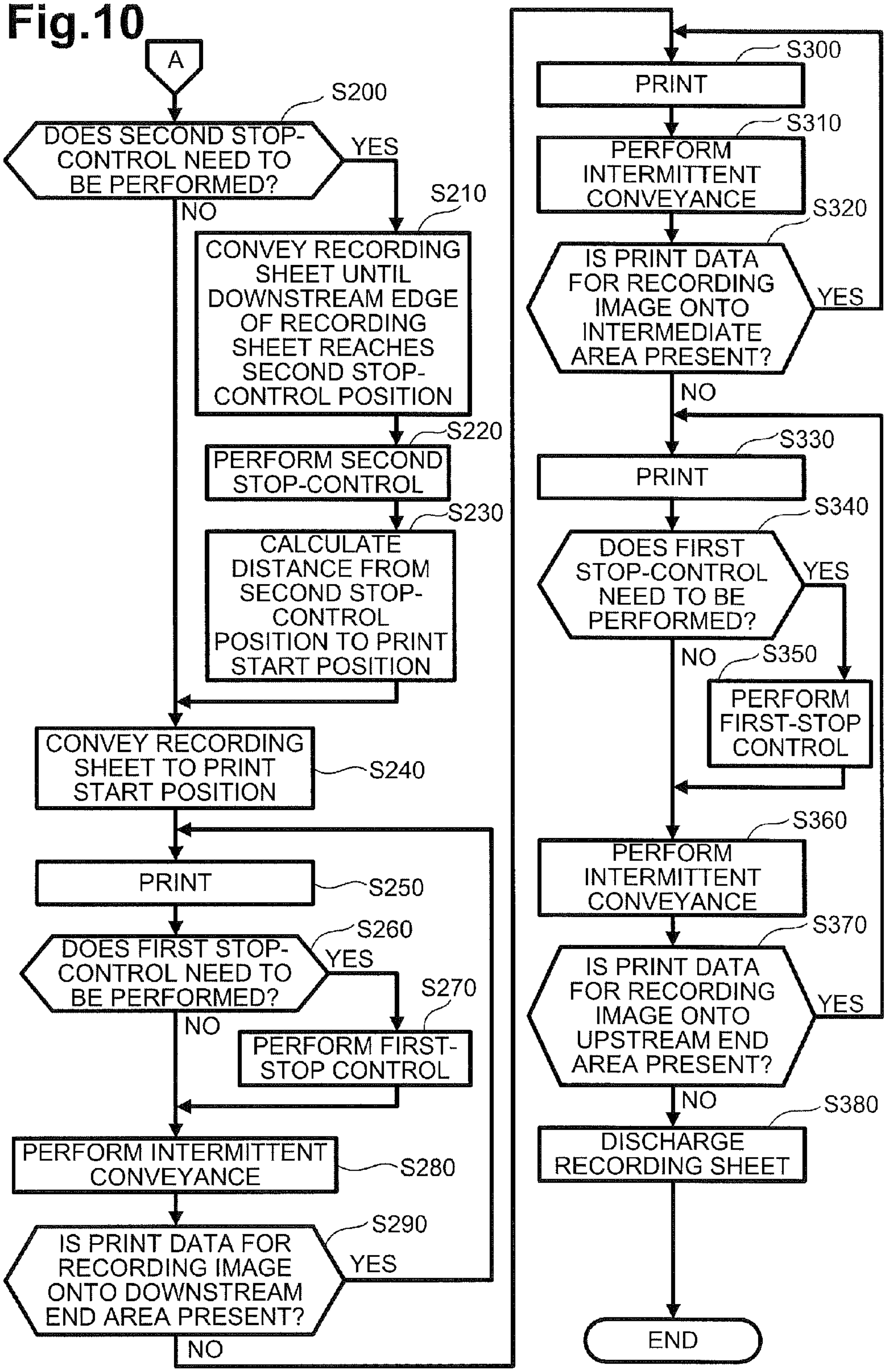

A
S200
DOES SECOND STOP-CONTROL NEED TO BE PERFORMED?
YES
NO
S210
CONVEY RECORDING SHEET UNTIL DOWNSTREAM EDGE OF RECORDING SHEET REACHES SECOND STOP-CONTROL POSITION
S220
PERFORM SECOND STOP-CONTROL
S230
CALCULATE DISTANCE FROM SECOND STOP-CONTROL POSITION TO PRINT START POSITION
CONVEY RECORDING SHEET TO PRINT START POSITION
S240
PRINT
S250
S260
DOES FIRST STOP-CONTROL NEED TO BE PERFORMED?
YES
NO
S270
PERFORM FIRST-STOP CONTROL
PERFORM INTERMITTENT CONVEYANCE
S280
S290
IS PRINT DATA FOR RECORDING IMAGE ONTO DOWNSTREAM END AREA PRESENT?
YES
NO
S300
PRINT
S310
PERFORM INTERMITTENT CONVEYANCE
S320
IS PRINT DATA FOR RECORDING IMAGE ONTO INTERMEDIATE AREA PRESENT?
YES
NO
S330
PRINT
S340
DOES FIRST STOP-CONTROL NEED TO BE PERFORMED?
YES
NO
S350
PERFORM FIRST-STOP CONTROL
S360
PERFORM INTERMITTENT CONVEYANCE
S370
IS PRINT DATA FOR RECORDING IMAGE ONTO UPSTREAM END AREA PRESENT?
YES
NO
S380
DISCHARGE RECORDING SHEET
END

Fig.11A

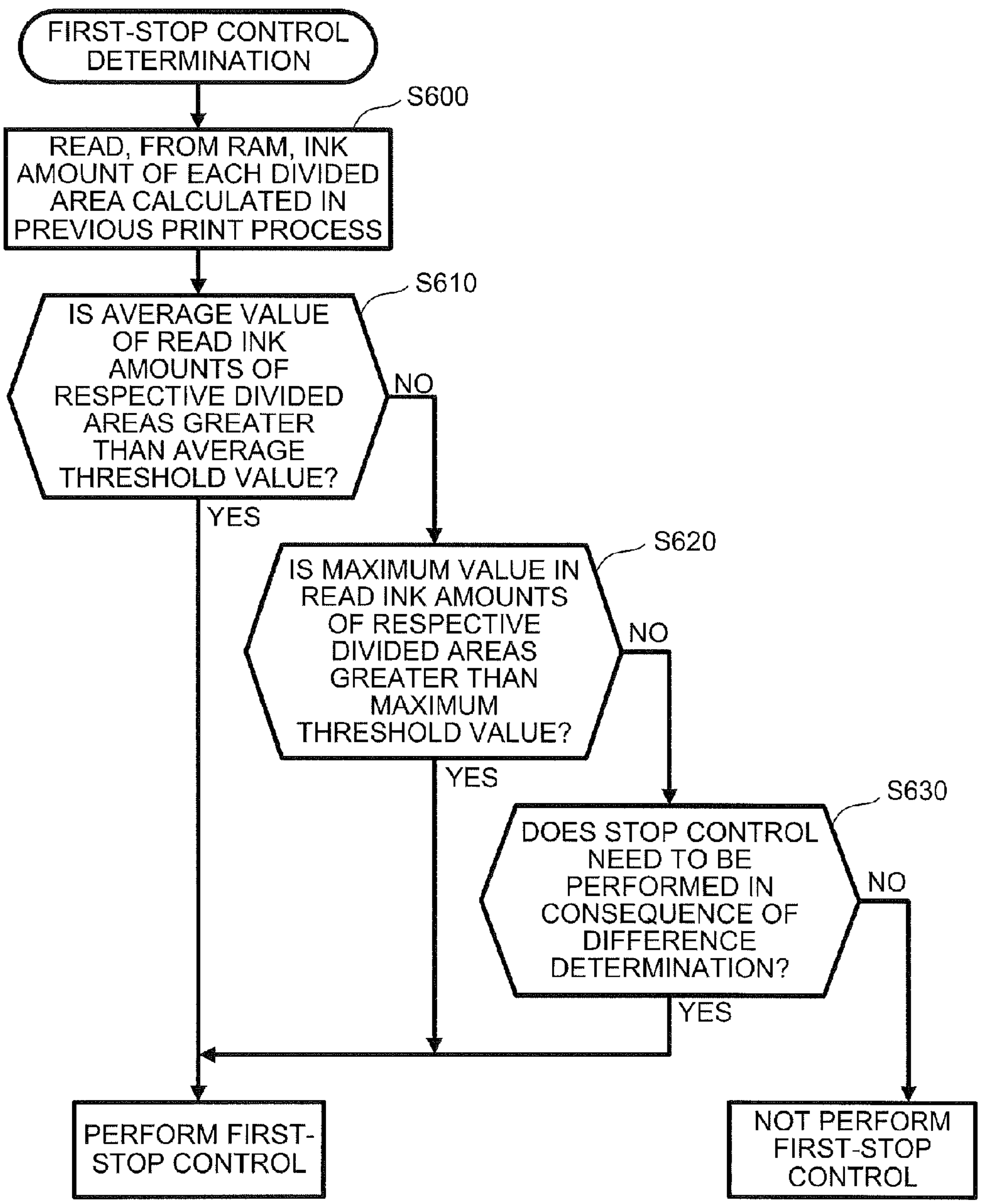

FIRST-STOP CONTROL DETERMINATION
S600
READ, FROM RAM, INK AMOUNT OF EACH DIVIDED AREA CALCULATED IN PREVIOUS PRINT PROCESS
S610
IS AVERAGE VALUE OF READ INK AMOUNTS OF RESPECTIVE DIVIDED AREAS GREATER THAN AVERAGE THRESHOLD VALUE?
NO
YES
S620
IS MAXIMUM VALUE IN READ INK AMOUNTS OF RESPECTIVE DIVIDED AREAS GREATER THAN MAXIMUM THRESHOLD VALUE?
NO
YES
S630
DOES STOP CONTROL NEED TO BE PERFORMED IN CONSEQUENCE OF DIFFERENCE DETERMINATION?
NO
YES
PERFORM FIRST-STOP CONTROL
NOT PERFORM FIRST-STOP CONTROL

Fig.11B

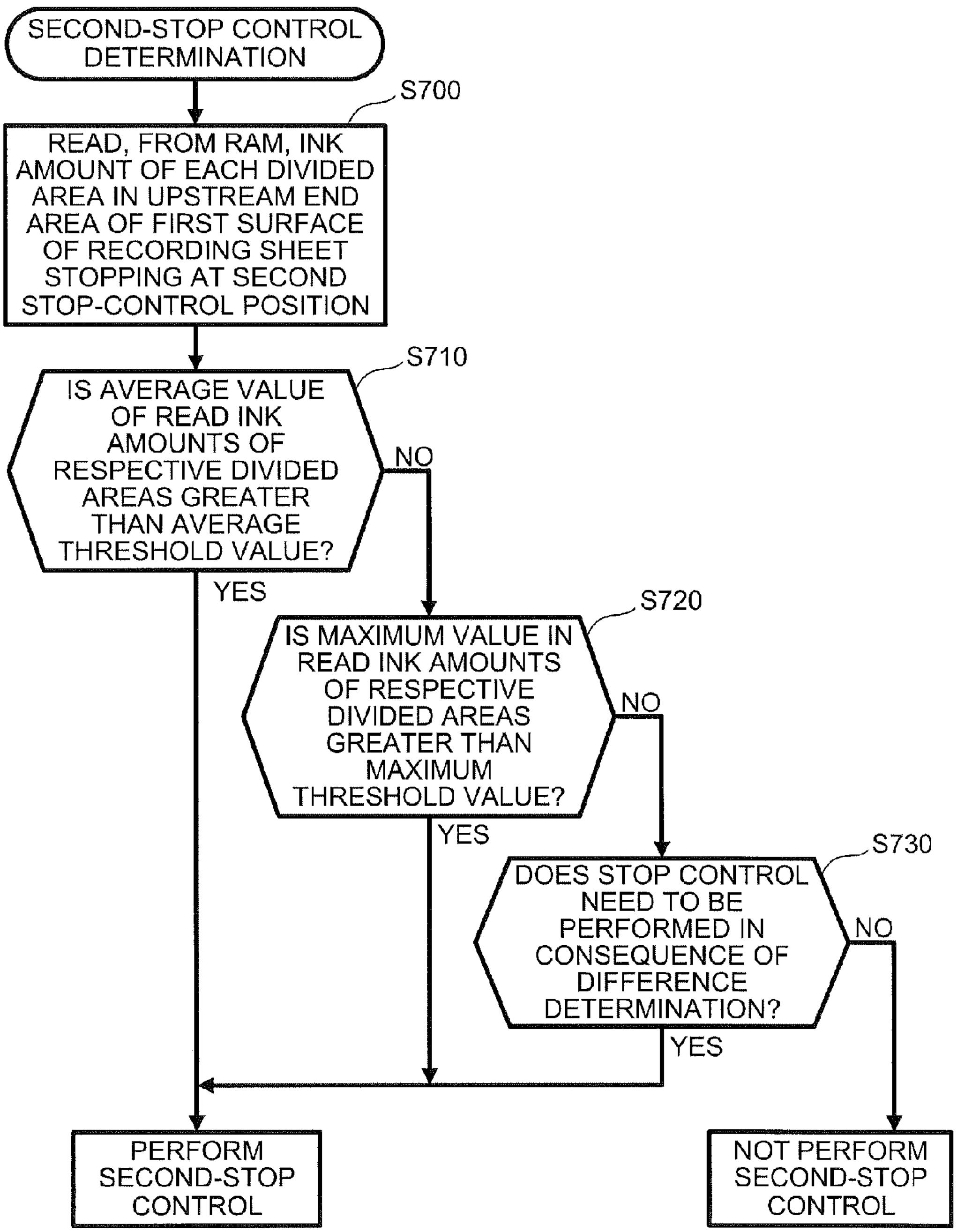

SECOND-STOP CONTROL DETERMINATION
S700
READ, FROM RAM, INK AMOUNT OF EACH DIVIDED AREA IN UPSTREAM END AREA OF FIRST SURFACE OF RECORDING SHEET STOPPING AT SECOND STOP-CONTROL POSITION
S710
IS AVERAGE VALUE OF READ INK AMOUNTS OF RESPECTIVE DIVIDED AREAS GREATER THAN AVERAGE THRESHOLD VALUE?
NO
YES
S720
IS MAXIMUM VALUE IN READ INK AMOUNTS OF RESPECTIVE DIVIDED AREAS GREATER THAN MAXIMUM THRESHOLD VALUE?
NO
YES
S730
DOES STOP CONTROL NEED TO BE PERFORMED IN CONSEQUENCE OF DIFFERENCE DETERMINATION?
NO
YES
PERFORM SECOND-STOP CONTROL
NOT PERFORM SECOND-STOP CONTROL

Fig.11C

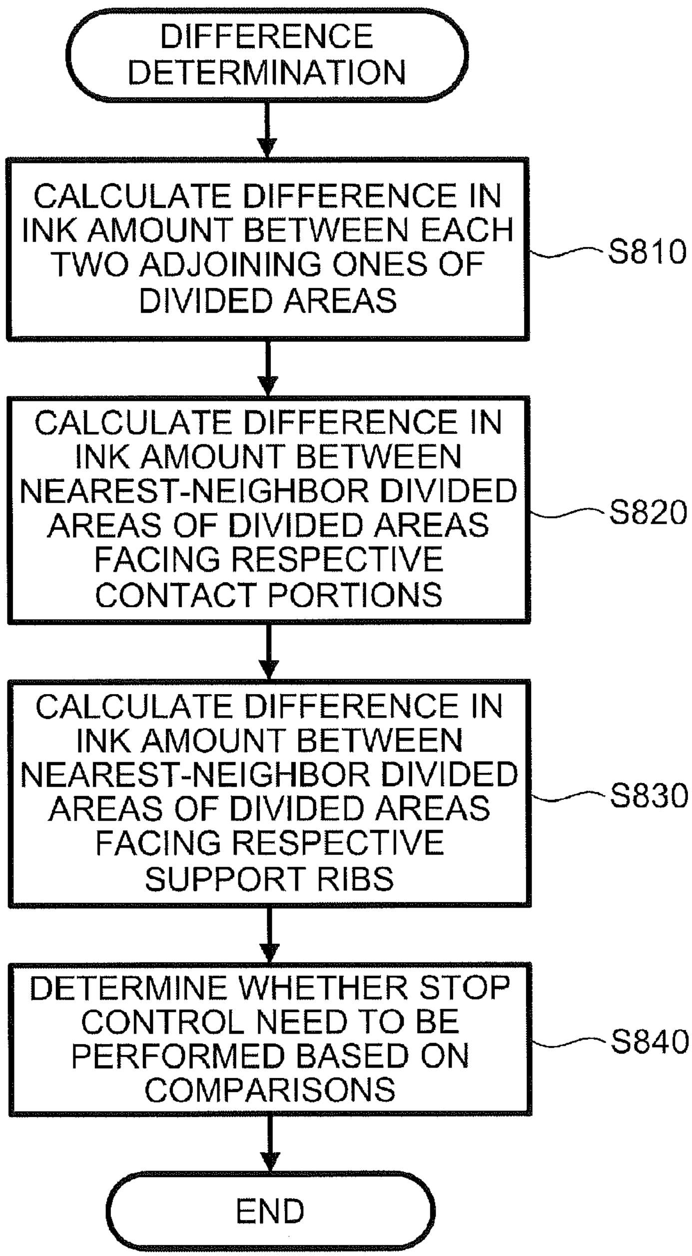

DIFFERENCE DETERMINATION
CALCULATE DIFFERENCE IN INK AMOUNT BETWEEN EACH TWO ADJOINING ONES OF DIVIDED AREAS
S810
CALCULATE DIFFERENCE IN INK AMOUNT BETWEEN NEAREST-NEIGHBOR DIVIDED AREAS OF DIVIDED AREAS FACING RESPECTIVE CONTACT PORTIONS
S820
CALCULATE DIFFERENCE IN INK AMOUNT BETWEEN NEAREST-NEIGHBOR DIVIDED AREAS OF DIVIDED AREAS FACING RESPECTIVE SUPPORT RIBS
S830
DETERMINE WHETHER STOP CONTROL NEED TO BE PERFORMED BASED ON COMPARISONS
S840
END

Fig.12A

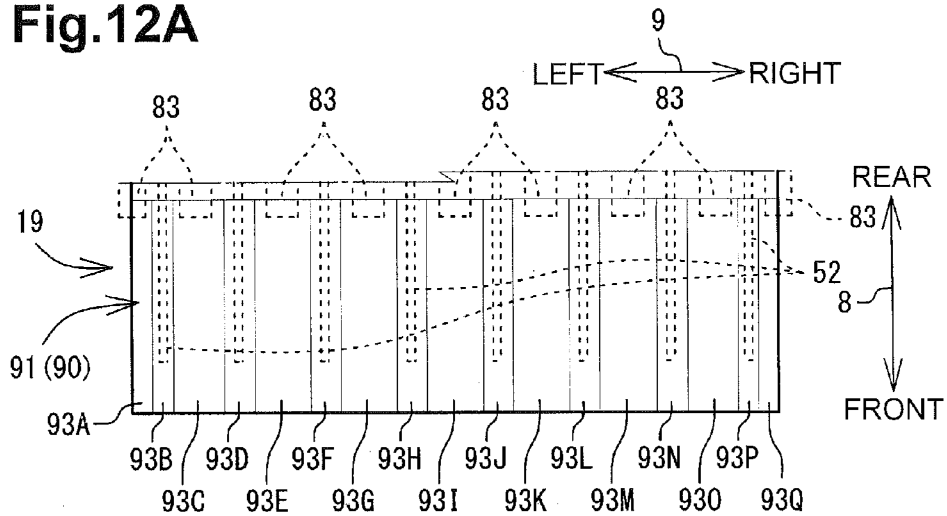


Fig.12B

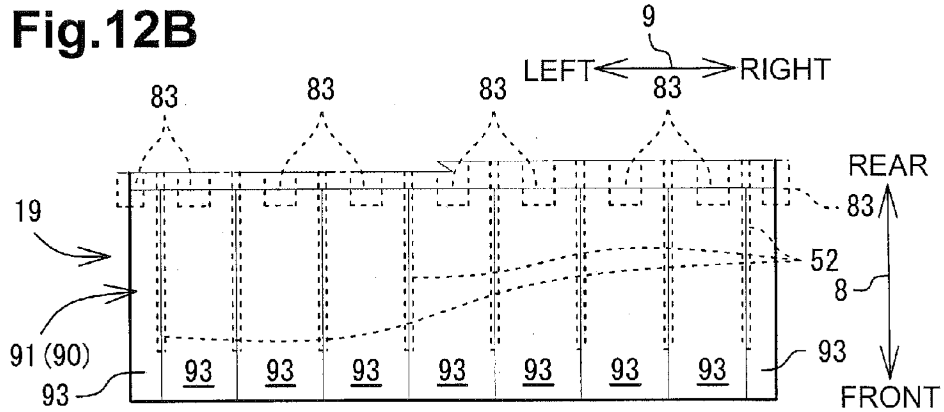


Fig.12C

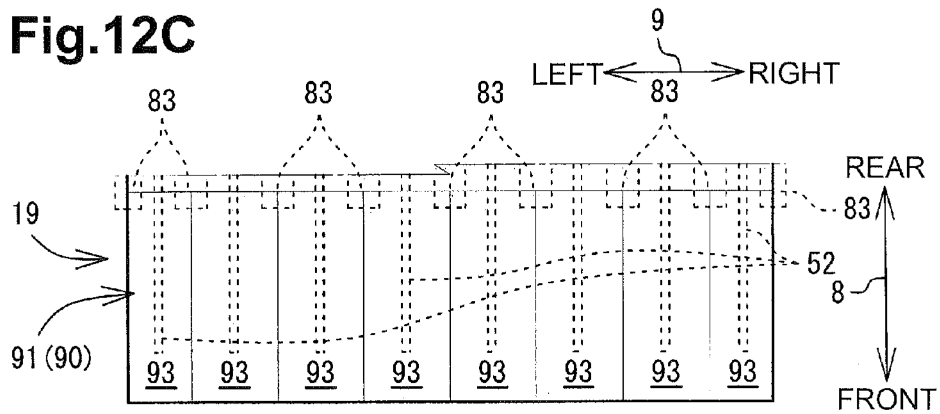
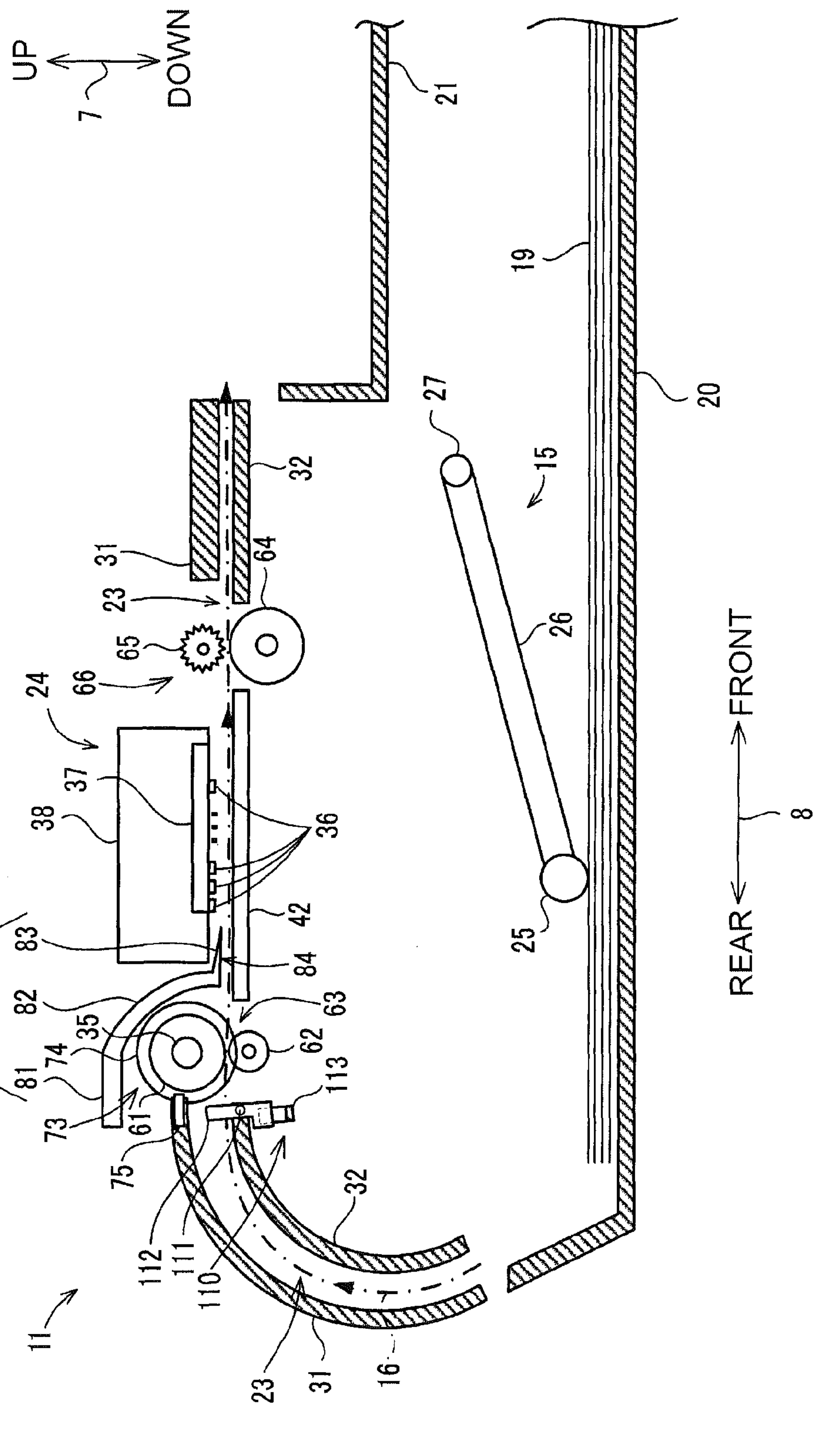


Fig.13


UP
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83
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112
111
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16
11
FRONT
REAR
8

INKJET RECORDING APPARATUS

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority from Japanese Patent Application No. 2012-098306, filed on Apr. 24, 2012, which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

Aspects described herein relate to an inkjet recording apparatus that records an image onto a sheet by ejecting ink droplets onto the sheet.

BACKGROUND

A known inkjet recording apparatus records an image onto a sheet by ejecting ink droplets onto the sheet. The image recording by the inkjet recording apparatus is implemented by ejecting ink droplets toward the sheet from nozzles provided in a recording portion.

In the known inkjet recording apparatus, a problem, such as cockling, may occur. Cockling generally refers to deformation of a sheet in which ink droplets are absorbed, and the deformation causes curling or rippling in the sheet. When cockling occurs in the sheet, a distance (e.g., a head gap) between the sheet and the recording portion may vary during image recording. The head gap variations cause an undesired contact of the sheet with the recording portion or improper conveyance of the sheet in which a leading edge of the sheet is shifted from a desired position. These issues may lead to a paper jam in the known inkjet recording apparatus.

Another known image recording apparatus is configured to address the above-described problem and perform double-sided printing. After recording an image on one surface (e.g., a front surface) of a sheet, the other known image recording apparatus stops conveyance of the sheet in a U-shaped conveyance path for a predetermined time period before recording an image on the other surface (e.g., a back surface) of the sheet. By doing so, the sheet is intentionally curled in a substantially U-shape. When a curl direction that the sheet is intentionally curled is opposite to a curl direction that the sheet is curled due to the cockling, the curling caused intentionally and the curling caused by the cockling in the sheet compensate for each other. Therefore, the deformation of the sheet due to the cockling may be relieved.

SUMMARY

However, in the other known image recording apparatus, when the curl direction that the sheet is intentionally curled is the same as the curl direction that the sheet is curled due to the cockling, the curling in the sheet may get worse instead. In the sheet in which the cockling occurs, a location where the sheet is deformed or a direction that the sheet is deformed may vary depending on a location in which a large amount of ink droplets ejected onto the sheet. Therefore, in the other known image recording apparatus configured to curl a sheet intentionally in the U-shaped conveyance path, the curling caused by the cockling in the sheet may not be compensated accurately.

Accordingly, aspects of the disclosure are provided in view of the problem described above. For example, some embodiments of the disclosure provide for an inkjet recording apparatus that may reduce an occurrence of a paper jam caused by deformation of a sheet due to penetration of ink droplets in the sheet.

In one or more examples, an image recording apparatus may comprise a first conveyor, a support portion, a recording portion, a contact portion, and a control device. The first conveyor may be configured to convey the sheet in a conveyance direction. The support portion may comprise a plurality of protrusions spaced apart from each other with respect to a width direction perpendicular to the conveyance direction. The support portion may be disposed downstream of the first conveyor with respect to the conveyance direction and configured to support from below. The recording portion may be disposed opposingly above the support portion and configured to record an image onto the sheet supported by the support portion based on print data by ejecting ink droplets from nozzles. The contact portion may be disposed between a pair of protrusions of the plurality of protrusions with respect to the width direction and in a manner that the contact portion faces the support portion. The control device may be configured to determine, based pm the print date, a value related to an amount of ink needed to form an image, corresponding to the print date, on the sheet, determine, determine whether to stop conveyance of the sheet, in a state where the sheet faces the contact portion, based on the value, and stop the conveyance of the sheet in response to determining that the conveyance of the sheet is to be stopped.

In some examples, an image recording apparatus may comprise a conveyor, a support portion, a recording portion, a corrugate mechanism, and a control device. The conveyor may be configured to convey the sheet in a conveyance direction along the guide portion in a conveyance path. The support portion may be disposed downstream of the conveyor with respect to the conveyance direction and configured to support from below the sheet being conveyed in the conveyance path. The recording portion may be disposed opposingly above the support portion and configured to record an image onto the sheet supported by the support portion based on print data by ejecting ink droplets from nozzles. The corrugate mechanism may be configured to form a corrugated shape in the sheet. The control device may be configured to determine, based on the print data, a value related to an amount of ink needed to form an image, corresponding to the print data, on the sheet, determine whether to stop conveyance of the sheet, in a state where the sheet faces the corrugate mechanism, based on the value, and stop the conveyance of the sheet in response to determining that the conveyance of the sheet is to be stopped.

In other examples, an image recording apparatus may comprise a first conveyor, a support portion, a recording portion, a contact portion, and a control device. The first conveyor may be configured to convey a sheet in a conveyance direction. The support portion may comprising a plurality of protrusions spaced apart from each other with respect to a width direction perpendicular to the conveyance direction, wherein the support portion is may be disposed downstream of the first conveyor with respect to the conveyance direction and configured to support the sheet from below. The recording portion may be disposed opposingly above the support portion and configured to record an image onto the sheet supported by the support portion based on print data by ejecting ink droplets from nozzles. The contact portion may be disposed between a pair of protrusions of the plurality of protrusions with respect to a width direction and in a manner that the contact portion faces the support portion. The control device may be configured to determine whether to stop conveyance of the sheet, in a state where the sheet faces the contact portion, based on the image to be recorded corresponding to the print data, and stop the conveyance of the sheet in response to determining that the conveyance of the sheet is to be stopped.

According to the aspects of the disclosure, the corrugated shape formed in the sheet by the pressing of the contact portion may relieve deformation of the downstream end area of the sheet with respect to the conveyance direction. Thus, an occurrence of a paper jam caused by the deformation of the sheet due to absorption of ink droplets in the sheet may be reduced.

DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present disclosure, needs satisfied thereby, and the objects, features, and advantages thereof, reference now is made to the following descriptions taken in connection with the accompanying drawing.

FIG. **1** is a perspective view depicting an inkjet recording apparatus in an illustrative embodiment according to one or more aspects of the disclosure.

FIG. **2** is a schematic longitudinal sectional view depicting an internal configuration of a printer portion in the illustrative embodiment according to one or more aspects of the disclosure.

FIG. **3** is a perspective view depicting contact members, a conveyor roller, a discharge roller pair, a reverse roller pair, and a platen in the illustrative embodiment according to one or more aspects of the disclosure.

FIG. **4** is a front view depicting the platen, the contact members, and a recording sheet in the illustrative embodiment according to one or more aspects of the disclosure.

FIG. **5** is a block diagram depicting a configuration of a control device in the illustrative embodiment according to one or more aspects of the disclosure.

FIG. **6** is a schematic view depicting divided areas simulatively defined on a recording surface of a recording sheet in the illustrative embodiment according to one or more aspects of the disclosure.

FIGS. **7**A, **7**C, **7**E, and **7**G are schematic sectional views depicting the printer portion for explaining a condition of a recording sheet during recording control in the illustrative embodiment according to one or more aspects of the disclosure.

FIGS. **7**B, **7**D, **7**F, and **7**H are schematic plan views depicting the recording sheet and the platen during the recording control in FIGS. **7**A, **7**C, **7**E, and **7**G, respectively, in the illustrative embodiment according to one or more aspects of the disclosure.

FIGS. **8**A, **8**C, **8**E, and **8**G are schematic sectional views depicting the printer portion for explaining a condition of a recording sheet during recording control in a fourth variation of the illustrative embodiment according to one or more aspects of the disclosure.

FIGS. **8**B, **8**D, **8**F, and **8**H are schematic plan views depicting the recording sheet and the platen during the recording control in FIGS. **8**A, **8**C, **8**E, and **8**G, respectively, in the fourth variation of the illustrative embodiment according to one or more aspects of the disclosure.

FIG. **9** is a flowchart depicting a recording control process in the illustrative embodiment according to one or more aspects of the disclosure.

FIG. **10** is a continuation of the flowchart of FIG. **9** in the illustrative embodiment according to one or more aspects of the disclosure.

FIG. **11**A is a flowchart depicting a first stop-control determination process in the illustrative embodiment according to one or more aspects of the disclosure.

FIG. **11**B is a flowchart depicting a second stop-control determination process in the illustrative embodiment according to one or more aspects of the disclosure.

FIG. **11**C is a flowchart depicting a difference determination process in the illustrative embodiment according to one or more aspects of the disclosure.

FIGS. **12**A-**12**C are schematic plan views depicting a recording sheet, the contact portions, and support ribs for explaining definitions of the divided areas in the recording sheet in the illustrative embodiment according to one or more aspects of the disclosure.

FIG. **13** is a schematic longitudinal sectional view depicting an internal configuration of another printer portion in a first variation of the illustrative embodiment according to one or more aspects of the disclosure.

DETAILED DESCRIPTION

Illustrative embodiments according to one or more aspects are described below with reference to the accompanying drawings. The illustrative embodiments described below are only examples. Various changes, arrangements and modifications may be applied therein without departing from the spirit and scope of the disclosure. As depicted in FIG. **1**, an up-down direction **7** may be defined with reference to an orientation of a multifunction peripheral **10** that may be disposed in which it may be intended to be used. A side of the multifunction peripheral **10**, in which an opening **13** may be defined, may be defined as the front of the multifunction peripheral **10**. A front-rear direction **8** may be defined with reference to the front of the multifunction peripheral **10**. A right-left direction **9** may be defined with respect to the multifunction peripheral **10** as viewed from its front.

As depicted in FIG. **1**, the multifunction peripheral **10** may have a substantially rectangular parallelepiped shape and a relatively lower height. The multifunction peripheral **10** may comprise a scanner portion **12** in an upper part thereof. The scanner portion **12** may be configured to read an image from a document, such as a recording sheet, by an image sensor, to obtain print data. The multifunction peripheral **10** may further comprise a printer portion **11** (an example of an inkjet recording apparatus) in a lower part thereof. The printer portion **11** may be configured to record an image onto a recording sheet **19** (an example of a sheet) (see FIG. **2**) based on print data obtained by the scanner portion **12** or print data transmitted from an external device, e.g., a personal computer, connected with the multifunction peripheral **10** via a local-area network ("LAN").

A sheet feed tray **20** (see FIG. **2**) may be disposed in the opening **13** defined in the front of the printer portion **11**. The sheet feed tray **20** may be configured such that one or more recording sheets **19** are to be placed thereon. The sheet feed tray **20** may be configured to be inserted into or removed from the printer portion **11** by which the sheet feed tray **20** may be slid along the front-rear direction **8**. An upper front part of the sheet feed tray **20** may be covered by a sheet discharge tray **21**. The sheet discharge tray **21** may be configured to be slidable integrally with the sheet feed tray **20**.

As depicted in FIG. **2**, the printer portion **11** may comprise a main conveyance path **23**, a reverse conveyance path **67**, a sheet feed portion **15**, a conveyor roller pair **63** (an example of a first conveyor), a discharge roller pair **66**, a reverse roller pair **43** (an example of a second conveyor), an inkjet-type recording portion **24**, and a path switching member **41**. The main conveyance path **23** and the reverse conveyance path **67** may be configured to guide a recording sheet **19** therein. The sheet feed portion **15** may be configured to feed one or more recording sheets **19** placed on the sheet feed tray **20** to the main conveyance path **23**. The conveyor roller pair **63** may be disposed in the main conveyance path **23** and configured to convey the recording sheet **19** fed into the main conveyance path **23** by the sheet feed portion **15**. The recording portion **24** may be configured to record an image onto the recording sheet **19** based on print data.

As depicted in FIG. **2**, the sheet feed portion **15** may be disposed above the sheet feed tray **20** attached in the opening **13** (see FIG. **1**) of the printer portion **11**. The sheet feed portion **15** may comprise a feed roller **25**, a feed arm **26**, and a shaft **27**.

The feed roller **25** may be rotatably disposed on one end of the feed arm **26**. The feed roller **25** may be configured to be rotated by a drive force applied by a sheet feed motor **102** (see FIG. **5**). Nevertheless, in other embodiments, the feed roller **25** may be configured to be rotated by a drive force applied by a conveyor motor **101**.

The feed arm **26** may be pivotably disposed on the shaft **27** supported by a frame of the printer portion **11**. The feed arm **26** may be pivotably urged toward the sheet feed tray **20** by its own weight or an elastic force of a spring. The feed roller **25** may be configured to pick up a recording sheet **19** from the stack of recording sheets **19** placed on the sheet feed tray **20** to feed the recording sheet **19** into the main conveyance path **23** by its rotation.

As depicted in FIG. **2**, the main conveyance path **23** may extend upward from a rear end of the sheet feed tray **20** and be curved toward the front. The main conveyance path **23** may pass under the recording portion **24** and further extend to the sheet discharge tray **21**. The main conveyance path **23** may be a space defined by a first guide member **31** and a second guide member **32**. The first guide member **31** and the second guide member **32** may be spaced apart from each other at a predetermined interval. The first guide member **31** may define an outer side of the main conveyance path **23**, while the second guide member **32** may define an inner side of the main conveyance path **23**. The first guide member **31** and the second guide member **32** may be, separately or collectively. The recording sheet **19** may be conveyed through the main conveyance path **23** in a direction of an arrow indicated by a dotted and dashed line in FIG. **2**. For example, a conveyance direction **16** may correspond to a direction that the main conveyance path **23** extends.

As depicted in FIG. **2**, the conveyor roller pair **63** comprising a conveyor roller **61** and a pinch roller **62** may be disposed upstream of the recording portion **24** in the main conveyance path **23** with respect to the conveyance direction **16**. The pinch roller **62** may be in pressure contact with a roller surface of the conveyor roller **61** by an elastic member (not depicted), e.g., a spring. A discharge roller pair **66** comprising a discharge roller **64** and a spur **65** may be disposed downstream of the recording portion **24** in the main conveyance path **23** with respect to the conveyance direction **16**. The spur **65** may be in pressure contact with a roller surface of the discharge roller **64** by an elastic member (not depicted), e.g., a spring. A reverse roller pair **43** comprising a reverse roller **45** and a spur **46** may be disposed downstream of the discharge roller pair **66** in the main conveyance path **23** with respect to the conveyance direction **16**. The spur **46** may be in pressure contact with a roller surface of the reverse roller **45** by an elastic member (not depicted), e.g., a spring.

The conveyor roller **61**, the discharge roller **64**, and the reverse roller **45** may be configured to be rotated in either one of a normal direction and a reverse direction by transmission of a drive force from the conveyor motor **101** (see FIG. **5**). When each roller pair rotates in the normal direction while pinching a recording sheet **19** therebetween, each roller pair may be configured to convey the recording sheet **19** in the conveyance direction **16**. When each roller pair rotates in the reverse direction while pinching the recording sheet **19** therebetween, each roller pair may be configured to convey the recording sheet **19** in a direction opposite to the conveyance direction **16**. For a double-sided image recording, a direction that the recording sheet **19** is being conveyed between the discharge roller **64** and the reverse roller **45** in the main conveyance path **23** may be switched to the opposite direction. Then, the recording sheet **19** may be conveyed toward the reverse conveyance path **67**.

As depicted in FIG. **2**, a platen **42** (an example of a support portion) may be disposed between the conveyor roller pair **63** and the discharge roller pair **66** to define a part of a lower part of the main conveyance path **23**. The platen **42** may be configured to support the recording sheet **19** being conveyed in the main conveyance path **23** from below.

As depicted in FIG. **3**, the platen **42** may comprise a plurality of support ribs **52** (an example of a protrusion) on an upper surface thereof. The support ribs **52** may protrude upward from the upper surface of the platen **42**. The support ribs **52** may extend along the front-rear direction **8** and may be spaced apart from each other with respect to the right-left direction **9** (an example of a width direction) at a predetermined interval. The recording sheet **19** being conveyed in the main conveyance path **23** may be supported by the platen **42**, and more specifically, by the support ribs **52** provided on the upper surface of the platen **42**.

As depicted in FIG. **2**, the recording portion **24** may be disposed opposingly above the platen **42**. The recording portion **24** may comprise a carriage **38** and a recording head **37**. The carriage **38** may be supported by the frame of the printer portion **11**. The carriage **38** may be connected with a carriage drive motor **103** (see FIG. **5**) via a known belt mechanism (not depicted) and configured to reciprocate along the right-left direction **9** by transmission of a drive force from the carriage drive motor **103**.

The recording head **37** may comprise a plurality of nozzles **36** defined in its lower surface, ink channels (not depicted), and a piezoelectric element **44** (see FIG. **5**). The ink channels may connect sub-tanks (not depicted) with the nozzles **36**. The piezoelectric element **44** may be configured to deform the ink channels partially to allow the nozzles **36** to eject ink droplets therefrom. The nozzles **36** may be configured to eject ink droplets toward the platen **42**. The piezoelectric element **44** may be configured to be activated by power supplied by a control device **130** (see FIG. **5**).

Each sub-tank may be configured to store ink of one of colors of cyan, magenta, yellow, and black. In the illustrative embodiment, a first nozzle row (not depicted) comprising a plurality of the nozzles **36** may be provided for the sub-tank for cyan ink. The first nozzle row may extend along the front-rear direction **8**. Similar to the first nozzle row, a second nozzle row, a third nozzle row, and a fourth nozzle row may be provided for the sub-tank for magenta ink, the sub-tank for yellow ink, and the sub-tank for black ink, respectively. Thus, the nozzles **36** may be arranged in a plurality of rows extending along the conveyance direction **16** (i.e., the front-rear direction **8**). The nozzle rows may be arranged side by side in the right-left direction **9**.

The recording portion **24** may be configured to be controlled by the control device **130** (see FIG. **5**). With this control, in the recording portion **24**, ink droplets may be ejected toward the platen **42** from the nozzles **36** defined in the recording head **37** while the carriage **38** reciprocates along the right-left direction **9**. Thus, an image may be recorded on a recording sheet **19** held by the the platen **42**. When the recording head **37** has the nozzles **36** defined across an area that corresponds to an entire recording area of the recording sheet **19** in the right-left direction **9**, the recording portion **24** might not necessarily comprise the carriage **38**.

As depicted in FIGS. **2-4**, a plurality of contact members **80** may be disposed upstream of the nozzles **36** in the main conveyance path **23** with respect to the conveyance direction **16**. The contact members **80** may be spaced apart from each other with respect to the right-left direction **9**. In the illustrative embodiment, as depicted in FIG. **3**, for example, nine contact members **80** may be disposed. As depicted in FIGS. **2** and **3**, each contact member **80** may comprise a fixing portion **81**, a curved portion **82**, and a contact portion **83**.

The fixing portion **81** may be configured to be fixed to the frame of the printer portion **11**. The curved portion **82** may curvedly extend forward and downward from the fixing portion **81**. The contact portion **83** may have a plate-like shape. The contact portion **83** may be located upstream of the nozzles **36** of the recording head **37** (e.g., the rearmost nozzles of nozzles **36** in the respective rows) with respect to the conveyance direction **16** and opposite to the platen **42** when the fixing portion **81** is fixed to the frame of the printer portion **11**.

As depicted in FIG. **4**, the contact portion **83** may comprise a contact rib **85** on a lower surface **84** thereof. The contact rib **85** may protrude downward from the lower surface **84** of the contact portion **83**. A lower end of the contact rib **85** may be located lower than the lower surface of the recording head **37**, and may be configured to come into contact with an image recording surface, e.g., an upper surface, of the recording sheet **19** held on the platen **42**. With this configuration, the recording sheet **19** may be pressed downward, e.g., toward the platen **42**, by the contact portion **83**.

Each of the contact portions **83** may be disposed between respective pairs of the support ribs **52** disposed on the platen **42** in the right-left direction **9**. For example, the contact portions **83** might not face the support ribs **52**. As depicted in FIG. **4**, the support ribs **52** may protrude such that their upper ends may be located higher than the lower ends of the contact ribs **85** of the contact portions **83**. In some arrangements, an upper end of the platen **42** may be located lower than the lower ends of the contact portions **83**. With this configuration, the recording sheet **19** being conveyed in the main conveyance path **23** may be maintained in a corrugated shape between the platen **42** and the contact portions **83** when viewed from the front or the rear of the multifunction peripheral **10**.

As depicted in FIG. **2**, a detector **110** may be disposed upstream of the conveyor roller pair **63** in the main conveyance path **23** with respect to the conveyance direction **16**. The detector **110** may comprise a shaft **111**, a detector element **112**, and an optical sensor **113**. The detector element **112** may be configured to be pivotable about the shaft **111**. The optical sensor **113** may comprise a light-emitting device and a light-receiving device that may be configured to receive light emitted from the light-emitting device.

One end of the detector element **112** may protrude into the main conveyance path **23**. When an external force is not applied to the one end of the detector element **112**, the other end of the detector element **112** may be present in an optical path of light emitted from the light-emitting device to the light-receiving device in the optical sensor **113** to interrupt travel of light traveling the optical path. In this situation, the optical sensor **113** may be configured to output a low level signal to the control device **130** (see FIG. **5**). When the one end of the detector element **112** is pivoted toward the downstream of the conveyance direction **16** by a downstream edge of the recording sheet **19** being conveyed, the other end of the detector element **112** may be moved to out of the optical path. Thus, light may travel along the optical path. In this situation, the optical sensor **113** may be configured to output a high level signal to the control device **130**. The control device **130** may be configured to detect a downstream edge and an upstream edge of the recording sheet **19** with respect to the conveyance direction **16** in accordance with a signal outputted from the optical sensor **113**.

As depicted in FIG. **2**, a rotary encoder **73** may be disposed on the conveyor roller **61** to detect a rotation amount of the conveyor roller **61**. The rotary encoder **73** may comprise an encoder disk **74** and an optical sensor **75**. The encoder disk **74** may be disposed on a shaft **35** of the conveyor roller **61** and configured to rotate integrally with the conveyor roller **61**. The encoder disk **74** may have a pattern in which a transmitting portion and a non-transmitting portion may be alternately arranged in a circumference direction at regular intervals. The transmitting portion may allow light to pass therethrough and the non-transmitting portion may not allow light to pass therethrough. As the encoder disk **74** rotates, a pulse signal may be generated every time the optical sensor **75** detects the transmitting portion and the non-transmitting portion alternately. The generated pulse signal may be outputted to the control device **130** (see FIG. **5**). The control device **130** may be configured to calculate the rotation amount of the conveyor roller **61** based on the received pulse signals.

As depicted in FIG. **2**, the path switching member **41** may be disposed between the discharge roller **64** and the reverse roller **45**. The path switching member **41** may comprise auxiliary rollers **47**, **48**, a flap **49**, and a shaft **87**. The flap **49** may extend from the shaft **87** in substantially the conveyance direction **16** and may be rotatably supported by the shaft **87**. The spur-like auxiliary rollers **47**, **48** may be supported by the flap **49** via respective shafts.

The flap **49** may be configured to be pivotable between a sheet-discharge position (e.g., indicated by a dashed line in FIG. **2**) and a sheet-reverse position (e.g., indicated by a solid line in FIG. **2**). When the flap **49** is located in the sheet-discharge position, the flap **49** may allow the recording sheet **19** to be discharged onto the discharge tray **21**. When the flap **49** is located in the sheet-reverse position, an extended end portion **49**A of the flap **49** may be located lower than the extended end portion **49**A of the flap **49** located in the sheet-discharge position.

The flap **49** may be configured to stay in the sheet-reverse position under its own weight when the flap **49** is in a standby state. The flap **49** may be configured to be pivoted (e.g., raised) to the sheet-discharge position by the recording sheet **19** being conveyed in the main conveyance path **23**. Thereafter, the flap **49** (e.g., the auxiliary rollers **47**, **48**) may guide the recording sheet **19** while being in contact with the recording sheet **19**. When the upstream edge of the recording sheet **19** with respect to the conveyance direction **16** passes the auxiliary roller **47**, the flap **49** may be configured to pivot to the sheet-reverse position from the sheet-discharge position under its own weight. Therefore, the upstream edge of the recording sheet **19** with respect to the conveyance direction **16** may move downward. Thus, the direction in which the upstream edge of the recording sheet **19**, with respect to the conveyance direction **16**, points may be changed toward the reverse conveyance path **67**. When the reverse roller **45** rotates in the normal direction under this condition, the recording sheet **19** may be further conveyed in the conveyance direction **16** and thus discharged onto the discharge tray **21**. When the reverse roller **45** rotates in the reverse direction under this condition, the recording sheet **19** may be conveyed in a direction opposite to the conveyance direction **16** and thus may be led into the reverse conveyance path **67**.

The reverse conveyance path **67** may be branched off from the main conveyance path **23** at a first position **39** located between the discharge roller **64** and the reverse roller **45**. The reverse conveyance path **67** may join the main conveyance path **23** at a second position **40** located upstream of the conveyor roller **61** with respect to the conveyance direction **16**. The reverse conveyance path **67** may be a space defined by a third guide member **33** and a fourth guide member **34** that may face each other while being spaced apart from each other at a predetermined interval. The third guide member **33** may define an upper part of the reverse conveyance path **67**. The fourth guide member **34** may define a lower part of the reverse conveyance path **67**. The third guide member **33** and the fourth guide member **34** may be an example of a reverse guide portion. The recording sheet **19** may be conveyed in the reverse conveyance path **67** from the first position **39** to the second position **40** (e.g., a direction indicated by a double dotted and dashed line in FIG. **2**).

Hereinafter, referring to FIG. **5**, a schematic configuration of the control device **130** is described. Aspects of the disclosure may be implemented such that the control device **130** may perform a recording control in accordance with flowcharts in FIGS. **9** and **10**. The control device **130** may be configured to control operation of the multifunction peripheral **10**. The control device **130** may comprise a central processing unit ("CPU") **131**, a read-only memory ("ROM") **132**, a random-access memory ("RAM") **133**, an electrically erasable programmable read-only memory ("EEPROM") **134**, an application-specific integrated circuit ("ASIC") **135**, and an internal bus **137** that may connect them each other.

The ROM **132** may store programs (e.g., machine readable instructions) for controlling various operations including the recording control to be performed by the CPU **131**. The RAM **133** may be configured to be used as a storage area for temporary storing data and signals to be used when the CPU **131** carries out the program. The RAM **133** may be configured to accumulate ink amount data as database. The EEPROM **134** may be configured to store settings and flags that may need to be maintained after power of the multifunction peripheral **10** is turned off.

The conveyor motor **101**, the sheet feed motor **102**, and the carriage drive motor **103** may be connected to the ASIC **135**. The ASIC **135** may be equipped with a drive circuit for controlling each motor. As a drive signal for rotating a predetermined motor is inputted from the CPU **131** to the drive circuit corresponding to the predetermined motor, a drive current corresponding to the drive signal may be outputted to the motor corresponding to the drive circuit. Thus, the corresponding motor may be rotated. That is, the control device **130** may be configured to control each motor **101**, **102**, **103**.

A pulse signal outputted from the optical sensor **75** may be inputted to the ASIC **135**. The control device **130** may be configured to calculate the rotation amount of the conveyor roller **61** based on the pulse signal received from the optical sensor **75**. Then, the control device **130** may be configured to calculate a conveyed amount of a recording sheet **19** based on the rotation amount of the conveyor roller **61**. The optical sensor **113** may be connected with the ASIC **135**. The control device **130** may be configured to detect a downstream edge and an upstream edge of a recording sheet **19** with respect to the conveyance direction **16** at the disposed position of the detector **110**, based on a signal from the optical sensor **113**.

The piezoelectric element **44** may be connected to the ASIC **135**. The piezoelectric element **44** may be configured to be activated by power supplied from the control device **130** via a drive circuit (not depicted). The control device **130** may be configured to control the power supply to the piezoelectric element **44** in accordance with print data to allow the nozzles **36** arranged in each nozzle row to eject ink droplets selectively therefrom. In one example, the control device **130** may allow a part or all of the plurality of nozzles **36** to eject ink droplets therefrom. The control device **130** may be further configured to control a size of each ink droplet to be ejected from the nozzles **36** by controlling the power supply to the piezoelectric element **44** in accordance with the print data. For example, an amount of ink to be ejected from each nozzle **36** may be determined based on the print data and the control device **130** may allow the recording portion **24** to record an image onto a recording sheet **19** based on the print data.

The control device **130** may be configured to calculate an amount of ink ejected onto a sheet based on print data in a print process (e.g., steps S**40** and S**120** in FIGS. **9**, and S**250** and S**330** in FIG. **10**) of the recording control. The control device **130** may be configured to store the calculated ink amount in the RAM **133**.

The calculation of the ink amount may be performed, for example, as described below. The control device **130** may determine how many colors of ink of ink droplets have been ejected onto the recording sheet **19** (e.g., one color such as black, when monochrome printing is performed, or at least one color of four colors of cyan, magenta, yellow, and black, i.e., one to four colors, when color printing is performed) and a number of times ink droplets of each color has been ejected (e.g., the number of times ink droplets ejected may become greater as a print density becomes higher), with reference to print data, when an image was recorded on the recording sheet **19**. For each color, the control device **130** may calculate an amount of ejected ink by multiplying an amount of ink in one ink droplet by the number of ejections. Then, the control device **130** may add up the ejected ink amounts of ink of four colors. Thus, the total amount of ink ejected onto the recording sheet **19** may be calculated.

As described below, the control device **130** may be allowed to calculate an amount of ink ejected onto each end area **90** (see FIG. **6**) of a recording sheet **19** when an image is recorded. As depicted in FIG. **6**, the end areas **90** may refer to a downstream end area **91** and an upstream end area **92**, respectively, of a recording sheet **19** with respect to the conveyance direction **16**. The downstream end area **91** may refer to an area that may extend between a right edge and a left edge of a recording sheet **19** in the right-left direction **9** and further extend by a predetermined length L**1** in the direction opposite to the conveyance direction **16** from a downstream edge of the recording sheet **19** with respect to the front-rear direction **8**. The upstream end area **92** may refer to an area that may extend between the right edge and the left edge of the recording sheet **19** in the right-left direction **9** and further extend by a predetermined length L**2** in the conveyance direction **16** from an upstream edge of the recording sheet **19** with respect to the front-rear direction **8**.

In the illustrative embodiment, the control device **130** may be configured to calculate an ink amount for each of divided areas **93**. Divided areas **93** may correspond to a plurality of areas into which each of the downstream end area **91** and the upstream end area **92** may be divided. For example, the divided areas **93** may refer to a plurality of divided areas of the downstream end area **91** and the upstream end area **92** in the right-left direction **9**. In the illustrative embodiment, as depicted in FIG. **12**A, each of the downstream end area **91** and the upstream end area **92** may be divided into the plurality of divided areas **93** (e.g., divided areas **93**A-**93**Q) at boundaries defined at respective positions which may face a position between one support rib **52** and one contact portion **83** adjacent to the one support rib **52** with respect to the right-left direction **9**. In some examples, all of the divided areas **93** may have the same size. Alternatively, at least some of the divided areas **93** may different respective sizes. In the illustrative embodiment, both endmost ones of the divided areas **93** in the right-left direction **9** may have a size smaller than the other divided areas **93**.

In the printer portion **11** configured as described above, a series of recording control from the feeding of a recording sheet **19** to the recording an image onto the fed recording sheet **19** based on print data may be performed by the control device **130**. Hereinafter, referring to FIGS. **9** and **10**, a recording control process is described.

When the control device **130** detects an instruction to print an image on one or more recording sheets **19** issued via an operation portion **17** (see FIG. **1**) of the multifunction peripheral **10** or by an external device connected to the multifunction peripheral **10** (step S**10**), the control device **130** may allow the feed roller **25** to feed one or more recording sheets **19** from a stack placed on the sheet feed tray **20** into the conveyance path **23** (step S**20**). Then, the control device **130** may allow the conveyor roller pair **63** to convey the recording sheet **19**, one by one, by rotating the conveyor roller **61** in the normal direction until a downstream edge of the recording sheet **19** with respect to the conveyance direction **16** reaches a print start position where the downstream edge of the recording sheet **19** may face the recording portion **24** (step S**30**). The print start position may refer to a position where a downstream edge of an image recording area of a recording sheet **19** with respect to the conveyance direction **16** may face the nozzles **36** defined in an upstream end of the recording head **37** with respect to the conveyance direction **16**. With the performance of step S**30**, a so-called start finding process, in which a print start position on a first surface to be printed on the recording sheet **19** may be found, may be completed. The control device **130** may be configured to perform the start finding process for the recording sheet **19** whose first surface is to be printed, based on the signals outputted from the optical sensor **113** and the optical sensor **75**, e.g., the amount of the recording sheet **19** conveyed since a leading edge of the recording sheet **19** is detected by the detector **110**.

Next, the control device **130** may perform operations for recording an image onto the first surface of the recording sheet **19** (steps S**40**-S**160**). The operations may be repeatedly performed until all images based on the print data are recorded onto the recording sheet **19** (NO in step S**160**).

In the illustrative embodiment, the operation may be divided to three parts in which one part may comprise a recording of an image onto a downstream part of the recording sheet **19** with respect to the conveyance direction **16** (steps S**40**-S**80**) and another part may comprise a recording of an image onto an intermediate part of the recording sheet **19** with respect to the conveyance direction **16** (steps S**90**-S**110**), and a further part may comprise a recording of an image onto an upstream part of the recording sheet **19** with respect to the conveyance direction **16** (steps S**120**-S**160**). The downstream part of the recording sheet **19** with respect to the conveyance direction **16** may refer to the downstream end area **91** (see FIG. **6**) of the recording sheet **19**. The upstream part of the recording sheet **19** with respect to the conveyance direction **16** may refer to the upstream end area **92** (see FIG. **6**) of the recording sheet **19**. The intermediate part of the recording sheet **19** with respect to the conveyance direction **16** may refer to an intermediate area **94** (see FIG. **6**) of the recording sheet **19** other than the downstream end area **91** and the upstream end area **92**.

The control device **130** may perform intermittent conveyance (step S**70**) when an image is recorded on the downstream part of the recording sheet **19** with respect to the conveyance direction **16**. The control device **130** may perform the intermittent conveyance by controlling the conveyor motor **101** to allow the conveyor roller pair **63** and the discharge roller pair **66** to repeatedly and alternately convey the recording sheet **19** by a predetermined line feed and stop the conveyance of the recording sheet **19**. During stoppage of the conveyance of the recording sheet **19** in the intermittent conveyance, the control device **130** may allow the nozzles **36** to eject ink droplets therefrom by controlling the power supply to the piezoelectric element **44** while moving the carriage **38** in a main scanning direction (e.g., the right-left direction **9**) (step S**40**). More specifically, the control device **130** may allow the nozzles **36** to eject ink droplets therefrom in one pass in which the carriage **38** may move across a print area in the main scanning direction (e.g., the right-left direction **9**). The control device **130** may perform the printing onto the recording sheet **19** (step S**40**) until there is no more print data for an image to be recorded onto the downstream end area **91** (NO in step S**80**) while stopping the conveyance of the recording sheet **19** in the intermittent conveyance (step S**70**). The control device **130** may perform a first stop-control determination (step S**50**) and a first stop-control (step S**60**) between the printing onto the recording sheet **19** (step S**40**) and the conveyance of the recording sheet **19** (step S**70**).

According to some arrangements, when an image is recorded onto the intermediate part of the recording sheet **19** with respect to the conveyance direction **16**, the control device **130** may perform the printing onto the recording sheet **19** (step S**90**) until there is no more print data for recording the image onto the intermediate part (NO in step S**110**) while stopping the conveyance of the recording sheet **19** in the intermittent conveyance (step S**100**), similar to the case where an image is recorded onto the downstream part of the recording sheet **19** with respect to the conveyance direction **16**. However, when an image is recorded onto the intermediate part of the recording sheet **19** with respect to the conveyance direction **16**, the control device **130** might not perform the first stop-control determination and the first stop-control, as distinct from the case where an image is recorded onto the downstream part of the recording sheet **19** with respect to the conveyance direction **16**.

Also, when an image is recorded onto the upstream part of the recording sheet **19** with respect to the conveyance direction **16**, the control device **130** may perform the printing onto the recording sheet **19** (step S**120**) until there becomes no more print data for recording an image onto the upstream part (NO in step S**160**) while stopping the conveyance of the recording sheet **19** in the intermittent conveyance (step S**150**), similar to the case where an image is recorded onto the downstream part of the recording sheet **19** with respect to the conveyance direction **16**. When an image is recorded onto the upstream part of the recording sheet **19** with respect to the conveyance direction **16**, the control device **130** may perform the first stop-control determination (step S**130**) and the first stop-control (step S**140**), similar to the case where an image is recorded onto the downstream part of the recording sheet **19** with respect to the conveyance direction **16**.

When no more print data exists for recording an image onto the upstream end area **92** of the recording sheet **19**, e.g., when a recording of an image onto the first surface of the recording sheet **19** is completed (NO in step S**160**), the control device **130** may allow the discharge roller pair **66** and the reverse roller pair **43** to convey the recording sheet **19** by rotating the discharge roller **64** and the reverse roller **45** in the normal direction until the upstream edge of the recording sheet **19** reaches a turn-back position (step S**170**). The turn-back position may be defined between the auxiliary roller **47** and the auxiliary roller **48**.

When the upstream edge of the recording sheet **19** reaches the turn-back position, the control device **130** may change the rotational direction of the reverse roller **45** from the normal direction to the reverse direction. Thus, the recording sheet **19** may be conveyed in the opposite direction to the conveyance direction **16** and thus may be led into the reverse conveyance path **67**. In one example, the control device **130** may turn back the recording sheet **19** in the opposite direction (step S**180**). After that, the recording sheet **19** may be conveyed in the reverse conveyance path **67** by a roller pair (not depicted) disposed in the reverse conveyance path **67** and further conveyed in the main conveyance path **23** again via the second position **40**. Then, the control device **130** may detect the recording sheet **19** by the detector **110** (step S**190**).

The control device **130** may perform a second stop-control determination (step S**200**) to determine whether a second stop-control (step S**220**) needs to be performed. When the control device **130** determines that a second stop-control needs to be performed (YES in step S**200**), the control device **130** may convey the recording sheet **19** in the conveyance direction **16** until a downstream edge of the recording sheet **19** with respect to the conveyance direction **16** reaches a second stop-control position (step S**210**). The second stop-control position may refer to a position where the downstream edge of the recording sheet **19** with respect to the conveyance direction **16** may face the contact portions **83**, e.g., the downstream edge of the recording sheet **19** may come into contact with the contact portions **83**. In the illustrative embodiment, the second stop-control position may refer to a position depicted in FIG. **7**E, e.g., the downstream edge of the recording sheet **19** with respect to the conveyance direction **16** may come into contact with protruding ends of the contact portions **83**. The control device **130** may perform the conveyance of the recording sheet **19** whose second surface is to be printed to the second stop-control position (step S**210**) and the conveyance of the recording sheet **19** to the print start position (steps S**230** and S**240**) based on the signals outputted from the optical sensor **113** and the optical sensor **75**, e.g., the amount of recording sheet **19** conveyed since the leading edge of the recording sheet **19** is detected by the detector **110**.

When the control device **130** determines that the second stop-control need not to be performed (NO in step S**200**), the control device **10** may convey the recording sheet **19** in the conveyance direction **16** until the downstream edge of the recording sheet **19** with respect to the conveyance direction **16** reaches the print start position (step S**240**). With the performance of step S**240**, the start finding process in which a print start position on the second surface of the recording sheet **19** may be found may be completed.

Then, the control device **130** may perform operations of recording an image onto the second surface of the recording sheet **19** (steps S**250**-S**370**). The operations may be the same as the operation of recording an image onto the first surface of the recording sheet **19**. For example, processing of steps S**250**-S**370** may correspond to the processing of steps S**40**-S**160**, respectively.

When no more print data exists for recording an image onto the upstream end area **92** of the recording sheet **19**, e.g., when the recording of an image onto the second surface of the recording sheet **19** is completed (NO in step S**370**), the control device **130** may allow the discharge roller pair **66** and the reverse roller pair **43** to convey the recording sheet **19** to the sheet discharge tray **21** by rotating the discharge roller **64** and the reverse roller **45** in the normal direction (step S**380**). For example, the control device **130** may perform a process for discharging the recording sheet **19**.

Referring to FIGS. **7**A-**7**D, **7**G, **7**H, **9**, **10**, and **11**A, the first stop-control determination and the first stop-control are now described.

In the first stop-control determination, processing of steps S**600**-S**630** may be performed in each of steps S**50** and S**130** of FIG. **9** and steps S**260** and S**340** of FIG. **10**.

First, the first stop-control determination performed in each of steps S**50** and S**260**, e.g., the first stop-control determination for the downstream end areas **91** of the first and second surfaces, respectively, of the recording sheet **19** with respect to the conveyance direction **16**, is described. The control device **130** may read the ink amount needed for forming a corresponding portion of the image in each divided area **93** from the RAM **133** (step S**600**), wherein the ink amount has been calculated for each divided area **93** and stored in the RAM **133** in the previous step (e.g., the print process in which an image is recorded on the downstream end area **91** of the recording sheet **19** in step S**40** or S**250**).

The control device **130** may calculate an average value of the read ink amounts of the respective divided areas **93** constituting the downstream end area **91**. Then, the control device **130** may compare the calculated average value with a predetermined average threshold value α**1** (step S**610**). When the calculated average value is greater than the average threshold value α**1** (YES in step S**610**), the control device **130** may perform the first stop-control (step S**60** in FIG. **9** and step S**270** in FIG. **10**).

The first stop-control may be performed by the control device **130** to stop the conveyance of the recording sheet **19** for a predetermined time period. In the first stop-control in step S**60**, as depicted in FIGS. **7**A and **7**B, the conveyance of the recording sheet **19** may be stopped by the control device **130** in a state where the downstream end area **91** of the recording sheet **19** may face the nozzles **36** and the contact portions **83**. In the first stop-control in step S**270**, as depicted in FIGS. **7**G and **7**H, the conveyance of the recording sheet **19** may be stopped by the control device **130** in a state where the downstream end area **91** of the recording sheet **19** may face the nozzles **36** and the contact portions **83**. For example, an area including the downstream edge of the recording sheet **19** in the downstream end area **91** may face the nozzles **36** and an area not including the downstream edge of the recording sheet **19** in the downstream end area **91**, e.g., a part upstream of the part facing the nozzles **36** in the downstream end area **91**, may face the contact portions **83**.

When the calculated average value is smaller than or equal to the average threshold value α**1** (NO in step S**610**), the control device **130** may compare a maximum value in the ink amounts of the respective divided areas **93** constituting the downstream end area **91**, with a predetermined maximum threshold value β**1** (step S**620**). When the maximum value is greater than the maximum threshold value β**1** (YES in step S**620**), the control device **130** may also perform the first stop-control (steps S**60** in FIG. **9** and step S**270** in FIG. **10**).

When the maximum value is smaller than or equal to the maximum threshold value β**1** (NO in step S**620**), the control device **130** may perform a difference determination (step S**630**). In the difference determination, when the control device **130** determines that the stop control needs to be performed (YES in step S630), the control device 130 may perform the first stop-control (step S60 in FIG. 9 and step S270 in FIG. 10). In the difference determination, when the control device 130 determines that the stop control need not be be performed (NO in step S630), the control device 130 may perform the conveyance of the recording sheet 19 in the intermittent conveyance (step S70 in FIG. 9 and step S280 in FIG. 10).

Referring to FIG. 11C, the difference determination process is now described. First, the control device 130 may calculate a difference in ink amount between each two adjoining areas of the divided areas 93 in the downstream end area 91 with respect to the right-left direction 9 (step S810). For example, in FIG. 12A, the control device 130 may calculate a difference in ink amount between the divided area 93E and the right-adjoining divided area 93F and a difference in ink amount between the divided area 93E and the left-adjoining divided area 93D. In the illustrative embodiment, in step S810, in the recording sheet 19 having a shape of alternate ridge portions and groove portions (e.g., a corrugated shape) formed by the contact portions 83 and the support ribs 52, a difference in ink amount between a divided area 93 corresponding to one of the ridge portions and an adjoining divided area 93 corresponding to one of the groove portions may be calculated.

Of all the divided areas 93 constituting the downstream end area 91, for each of the divided areas 93 facing the respective contact portions 83, the control device 130 may calculate a difference in ink amount between each divided area 93 and its nearest-neighbor divided area 93, to the right and a difference in ink amount between each divided area 93 and its nearest-neighbor divided area 93 to the left (step S820). For example, in FIG. 12A, the control device 130 may calculate a difference in ink amount between the divided area 93E and its right nearest-neighbor divided area 93G and a difference in ink amount between the divided area 93E and its left nearest-neighbor divided area 93C.

Of all the divided areas 93 constituting the downstream end area 91, for each of the divided areas 93 facing the respective support ribs 52, the control device 130 may calculate a difference in ink amount between each divided area 93 and its right nearest-neighbor divided area 93 and a difference in ink amount between each divided area 93 and its left nearest-neighbor divided area 93 (step S830). For example, in FIG. 12A, the control device 130 may calculate a difference in ink amount between the divided area 93D and its right nearest-neighbor divided area 93F and a difference between the divided area 93D and its left nearest-neighbor divided area 93B.

In step S840, the control device 130 may compare each difference calculated in step S810 with a predetermined adjoining threshold value γ1, compare each difference calculated in step S820 with a predetermined first neighbor threshold value γ2 (as an example of a neighbor threshold value), and compare each difference calculated in step S830 with a predetermined second neighbor threshold value γ3 (as an example of the neighbor threshold value), and determine whether the stop control needs to be performed.

As a result of the comparison, when all of the differences compared with the adjoining threshold value γ1 are smaller than or equal to the adjoining threshold value γ1, the control device 130 may determine that the stop control need not to be performed (NO in step S630). Thus, the control device 130 may perform the conveyance of the recording sheet 19 in the intermittent conveyance (step S70 in FIG. 9 and step 5280 in FIG. 10). On the other hand, when at least one of the differences compared with the adjoining threshold value γ1 is greater than the adjoining threshold value γ1, the control device 130 may determine that the stop control needs to be performed (YES in step S630). Thus, the control device 130 may perform the first stop-control (step S60 in FIG. 9 and step S270 in FIG. 10).

In some arrangements, when at least one of the differences compared with the adjoining threshold value γ1 is greater than the adjoining threshold value γ1, as a result of the above comparisons, when at least one of the differences compared with the first neighbor threshold value γ2 is greater than the first neighbor threshold value γ2 or when at least one of the differences compared with the second neighbor threshold value γ3 is greater than the second neighbor threshold value γ3, the control device 130 may determine that the stop control need not to be performed (NO in step S630). Thus, the control device 130 may perform the conveyance of the recording sheet 19 in the intermittent conveyance (step S70 in FIG. 9 and step S280 in FIG. 10).

As described above, the control device 130 may determine whether the conveyance of the recording sheet 19 needs to be stopped in a state where the downstream end area 91 faces the nozzles 36 and the contact portions 83, based on the amount of ink ejected onto the downstream end areas 91 of the first and second surfaces, respectively, of the recording sheet 19 with respect to the conveyance direction 16.

The first stop-control performed in each step S130 and S340, e.g., the first stop-control determination for the upstream end areas 92 of the first and second surfaces, respectively, of the recording sheet 19 with respect to the conveyance direction 16 is now described. The control device 130 may read the ink amount of each divided areas 93 from the RAM 133 (step S600), wherein the ink amounts has been calculated for each divided area 93 and stored in the RAM 133 in the previous step (e.g., the print process in which an image is recorded on the upstream end areas 92 of the recording sheet 19 in step S120 or S330) (step S600).

The control device 130 may calculate an average value of the read ink amounts of the respective divided areas 93 constituting the upstream end area 92. Then, the control device 130 may compare the calculated average value with the predetermined average threshold value α1 (step S610). When the calculated average value is greater than the average threshold value α1 (YES in step S610), the control device 130 may perform the first stop-control (step S140 in FIG. 9 and step S350 in FIG. 10).

In the first stop-control in steps S130 and S340, the conveyance of the recording sheet 19 may be stopped by the control device 130 in a state where the upstream end area 92 of the recording sheet 19 may face the nozzles 36 and the contact portions 83, as depicted in FIGS. 7C and 7D. For example, an area including the upstream edge of the recording sheet 19 in the upstream end area 92 may face the nozzles 36 and an area not including the upstream edge of the recording sheet 19 in the upstream end area 92, e.g., a part downstream of the part facing the contact portions 83 in the upstream end area 92, may face the nozzles 36.

When the calculated average value is smaller than or equal to the average threshold value α1 (NO in step S610), the control device 130 may compare a maximum value in the ink amounts of the respective divided areas 93 constituting the upstream end area 92, with the predetermined maximum threshold value β1 (step S620). When the maximum value is greater than the maximum threshold value β1 (YES in step S620), the control device 130 may perform the first stop-control (steps S140 in FIG. 9 and step S350 in FIG. 10).

When the maximum value is smaller than or equal to the maximum threshold value β1 (NO in step S620), the control device **130** may perform the above-described difference determination (S**630**). The difference determination performed in the first stop-control determination in steps S**130** and S**340** may be different from the above-described difference determination in the following point. For example, in step S**630**, the control device **130** may calculate a difference in ink amount between each two adjoining ones of the divided areas **93** in the upstream end area **92**, but not the divided areas **93** in the downstream end area **91**, and compare the calculated differences with the threshold values, respectively, to determine whether the stop control needs to be performed.

When the control device **130** determines that the stop control needs to be performed (YES in step S**630**), the control device **130** may perform the first stop-control (step S**140** in FIG. **9** and step S**350** in FIG. **10**). When the control device **130** determines that the stop control need not to be performed (NO in step S**630**), the control device **130** may perform the conveyance of the recording sheet **19** in the intermittent conveyance (step S**140** in FIG. **9** and step S**350** in FIG. **10**).

As described above, the control device **130** may determine whether the conveyance of the recording sheet **19** needs to be stopped in a state where the upstream end area **92** faces the nozzles **36** and the contact portions **83**, based on the amount of ink ejected onto the upstream end area **92** of the first and second surfaces, respectively, of the recording sheet **19** with respect to the conveyance direction **16**.

Referring to FIGS. **7**E, **7**F, **10**, and **11**B, the second stop-control determination process is now described.

In the second stop-control determination, processing of steps S**700**-S**730** may be performed in step S**200** in FIG. **10**.

As depicted in FIG. **7**E, when the recording sheet **19** is stopped at the second stop-control position, the contact portions **83** may face the downstream end area **91** (more specifically, a downstream-edge side part of the downstream end area **91**) of the second surface of the recording sheet **19**. Under this condition, the control device **130** may read the ink amount of each divided area **93** opposite to the downstream end area **91** of the second surface, e.g., the ink amount of each divided area **93** in the upstream end area **92** of the first surface of the recording sheet **19** (step S**700**).

The control device **130** may calculate an average value of the read ink amounts of the respective divided areas **93** constituting the downstream end area **91** of the second surface of the recording sheet **19**. Then, the control device **130** may compare the calculated average value with a predetermined average threshold value α**2** (step S**710**). When the calculated average value is greater than the average threshold value α**2** (YES in step S**710**), the control device **130** may perform the processing of steps S**210**-S**230**.

In step **5210**, the control device **130** may convey the recording sheet **19** in the conveyance direction **16** until the downstream edge of the recording sheet **19** with respect to the conveyance direction **16** reaches the second stop-control position. Then, in step S**220**, the control device **130** may perform a second stop-control. The second stop-control may be performed by the control device **130** to stop the conveyance of the recording sheet **19** for a predetermined time period. In the second stop-control, as depicted in FIGS. **7**E and **7**F, the conveyance of the recording sheet **19** may be stopped by the control device **130** in a state where the downstream end area **91** of the recording sheet **19** may face the contact portions **83**. In step S**230**, the control device **130** may calculate a distance from the second stop-control position to the print start position along the conveyance path **23**. Then, in step S**240**, the control device **130** may convey the recording sheet **19** by the distance calculated in step **5230**.

When the average value calculated in step S**710** is smaller than or equal to the average threshold value α**2** (NO in step S**710**), the control device **130** may compare a maximum value in the ink amounts of the respective divided areas **93** constituting the downstream end area **91**, with a predetermined maximum threshold value β**2** (step S**720**). When the maximum value is greater than the maximum threshold value β**2** (YES in step S**720**), the control device **130** may perform the above-described processing of the steps S**210**-S**230**.

When the maximum value is smaller than or equal to the maximum threshold value β**2** (NO in step S**720**), the control device **130** may perform a difference determination (step S**730**). In the difference determination performed in step S**730**, the same processing as the processing performed in the difference determination of the first stop-control determination in steps S**50** and S**260** may be performed.

In the difference determination, when the control device **130** determines that the stop control needs to be performed (YES in step S**730**), the control device **130** may perform the processing of steps S**210**-S**230**. In the difference determination, when the control device **130** determines that the stop control need not be performed (NO in step S**730**), the control device **130** may perform the conveyance of the recording sheet **19** in the intermittent conveyance (step S**240** in FIG. **10**).

As described above, the control device **130** may determine whether the conveyance of the recording sheet **19** that an image is to be recorded on its second surface while the recording sheet **19** is conveyed in the main conveyance path **23** from the reverse conveyance path **67** via the second position **40** needs to be stopped in a state where the downstream edge of the recording sheet **19** with respect to the conveyance direction **16** faces the contact portions **83**, based on the amount of ink ejected onto the upstream end area **92** of the first surface of the recording sheet **19** that an image has been recorded on the first surface while the recording sheet was conveyed in the main conveyance path **23** from the sheet feed tray **20**.

According to the illustrative embodiment, a recording sheet **19** that an image has been recorded on its first surface conveyed from the sheet feed tray **20** into the main conveyance path **23** may be conveyed through the reverse conveyance path **67** from the first position **39** toward the second position **40** by the reverse roller pair **43** while an upstream edge of the recording sheet **19** with respect to the conveyance direction **16** when the image is recorded on the first surface thereof is regarded as a leading edge. Then, the recording sheet **19** may be conveyed again to the position where the recording sheet **19** may face the recording portion **24** through the main conveyance path **23**. Subsequently, an image may be recorded on a second surface of the recording sheet **19** by which ink droplets are ejected from the nozzles **36** while the recording sheet **19** faces the recording portion **24** again. The downstream edge and upstream edge of the recording sheet **19** may be reversed to each other with respect to the conveyance direction **16** between when an image is recorded on the second surface of the recording sheet **19** and when an image is recorded on the first surface of the recording sheet **19**. For example, the downstream edge of the recording sheet **19** with respect to the conveyance direction **16** when an image is recorded on the second surface of the recording sheet **19** may be the upstream edge of the recording sheet **19** with respect to the conveyance direction **16** when an image is recorded on the first surface of the recording sheet **19**.

In the illustrative embodiment, for example, when a large amount of ink has been ejected onto the upstream end area **92** of the first surface of the recording sheet **19** with respect to the conveyance direction **16** at the time the recording sheet **19** is conveyed into the main conveyance path **23** again from the reverse conveyance path **67** via the second position **40**, the conveyance of the recording sheet **19** may be stopped in a state where the downstream end area **91** (i.e., the opposite side to the upstream end area **92** on which a large amount of ink have been ejected) of the recording sheet **19** may be in contact with the contact portions **83**. In this state, the downstream end area **91** of the recording sheet **19** with respect to the conveyance direction **16** may be formed in a corrugated shape along the right-left direction **9** by which the recording sheet **19** is pressed by the contact portions **83** while being supported by the support ribs **52**. The corrugated shape formed in the recording sheet **19** may relieve the deformation of the downstream end area **91** of the recording sheet **19** with respect to the conveyance direction **16** caused by adhesion of the large amount of ink onto the recording sheet **19**. Thus, an occurrence of a paper jam caused by the deformation of the recording sheet **19** due to the penetration of ink droplets into the recording sheet **19** may be reduced.

According to the illustrative embodiment, when a large amount of ink droplets has been ejected onto the downstream end area **91** of the recording sheet **19** with respect to the conveyance direction **16**, the conveyance of the recording sheet **19** may be stopped while the recording sheet **19** is pressed by the contact portions **83** immediately upstream of the downstream end area **91**. Thus, the recording sheet **19** may become a corrugated shape along the right-left direction **9**. As a result, the deformation of the downstream end area **91** due to the penetration of the large amount of ink droplets into the recording sheet **19** may be relieved.

According to the illustrative embodiment, when a large amount of ink droplets has been ejected onto the downstream end area **91** of the recording sheet **19** with respect to the conveyance direction **16**, the conveyance of the recording sheet **19** may be stopped while the recording sheet **19** is pressed by the contact portions **83** immediately upstream of the upstream end area **92**. Thus, the recording sheet **19** may become a corrugated shape along the right-left direction **9**. As a result, the deformation of the upstream end area **92** due to the penetration of the large amount of ink droplets into the recording sheet **19** may be relieved.

When a large amount of ink droplets has been uniformly ejected onto the end area **90** of the recording sheet **19** with respect to the conveyance direction **16**, the recording sheet **19** may tend to be deformed in the end area **90**. According to the illustrative embodiment, in the above case, the conveyance of the recording sheet **19** may be stopped while the recording sheet **19** is pressed by the contact portions **83** immediately upstream of the end area **90**. Thus, the recording sheet **19** may be formed in a corrugated shape along the right-left direction **9**. As a result, the deformation of the end area **90** may be relieved.

When a large amount of ink droplets has been ejected onto a part of the end area **90** of the recording sheet **19** intensively with respect to the conveyance direction **16**, the recording sheet **19** may tend to be deformed in the part where the large amount of ink droplets penetrates. According to the illustrative embodiment, in the above case, the conveyance of the recording sheet **19** may be stopped while the recording sheet **19** is pressed by the contact portions **83** immediately upstream of the end area **90** including the part where the large amount of ink droplets penetrates. Thus, the recording sheet **19** may be formed in a corrugated shape along the right-left direction **9**. As a result, the deformation of the end area **90** including the part where the large amount of ink droplets penetrates may be relieved.

When a difference in ink amount between adjoining divided areas **93** of the end area **90** of the recording sheet **19** with respect to the conveyance direction **16** is greater than the threshold value, the recording sheet **19** may tend to be deformed at the boundary between the adjoining divided areas **93**. According to the illustrative embodiment, in the above case, the conveyance of the recording sheet **19** may be stopped while the recording sheet **19** is pressed by the contact portions **83** immediately upstream of the end area **90** including the boundary. Thus, the recording sheet **19** may be formed in a corrugated shape along the right-left direction **9**. As a result, the deformation of the end area **90** including the boundary may be relieved.

If the recording sheet **19** is formed in a corrugated shape along the right-left direction **9** by which the conveyance of the recording sheet **19** is stopped when a difference in ink amount between nearest-neighbors of the divided areas **93** including positions facing the contact portions **83** is greater than the threshold value, a degree of a ridge portion formed in the recording sheet **19** may become greater in one of the nearest-neighbor divided areas **93** in which the difference in ink amount therebetween is greater than the threshold value. Then, the greater ridge portion may cause deformation in the recording sheet **19**. Therefore, in the above-described illustrative embodiment, when the difference is greater than the threshold value, the conveyance of the recording sheet **19** may not be stopped. Thus, the deformation of the recording sheet **19** caused by the corrugation formed in the recording sheet **19** may be reduced.

In the illustrative embodiment, the end part **90** may be divided into the divided areas **93** that may be smaller than the divided areas **93** depicted in FIGS. **12**B and **12**C. With this configuration, the deformation of the recording sheet **19** may be precisely relieved.

In the above-described illustrative embodiment, the multifunction peripheral **10** may be allowed to perform the double-sided image recording. Nevertheless, in a first variation of the illustrative embodiment, for example, the multifunction peripheral **10** may be allowed to perform a single-sided image recording only, as depicted in FIG. **13**. In this case, the multifunction peripheral **10** may not comprise the configuration necessary for the double-sided image recording, such as the path switching member **41**, the third guide member **33** and the fourth guide member **34** defining the reverse conveyance path **67**, and the reverse roller pair **43**.

In the first variation, the processing of steps **S170**-**S370** for the double-sided image recording might not be performed in the flowchart of FIGS. **9** and **10** performed in the above-described illustrative embodiment. In the first variation, the conveyor roller pair **63** may be an example of a conveyor.

According to the first variation, in the multifunction peripheral **10** configured to record an image on only one surface of a recording sheet **19**, effects that may be the same as the effects provided by the multifunction peripheral **10** according to the above-described illustrative embodiment may be provided.

In the above-described illustrative embodiment, as depicted in FIG. **12**A, the end area **90** may be divided into the plurality of divided areas **93** at boundaries defined at respective positions each of which may face a position between one support rib **52** and one contact portion **83** adjacent to the one support rib **52** with respect to the right-left direction **9**. Nevertheless, in a second variation of the illustrative embodiment, for example, as depicted in FIG. **12**B, the end area **90** may be divided into a plurality of divided areas **93** at boundaries defined at respective positions facing the respective support ribs **52**.

In the second variation, the same processing may be performed in steps S810 and S820 in the flowchart of FIG. 11C according to the above-described illustrative embodiment. Therefore, the processing of step S810 and S820 may be integrated into a single step.

According to the second variation, when the divided area **93** where a large amount of ink droplets penetrates is deformed toward the nozzles **36**, the manner of dividing the end area **90** into the plurality of divided area **93** may relieve the deformation of the recording sheet **19** appropriately.

In the above-described illustrative embodiment, as depicted in FIG. **12**A, the end area **90** may be divided into a plurality of divided areas **93** at boundaries defined at respective positions each of which may face a position between one support rib **52** and one contact portion **83** adjacent to the one support rib **52** with respect to the right-left direction **9**. Nevertheless, in a third variation of the illustrative embodiment, for example, as depicted in FIG. **12**C, the end area **90** may be divided into a plurality of divided areas **93** at boundaries defined at respective positions facing the respective contact portions **83**.

In the third variation, the same processing may be performed in steps S810 and S830 in the flowchart of FIG. **11**C according to the above-described illustrative embodiment. Therefore, the processing of step S810 and S830 may be integrated into a single step.

According to the third variation, when the divided area **93** where a large amount of ink droplets penetrates is deformed to move away from the nozzles **36**, the manner of dividing the end area **90** into the plurality of divided area **93** may relieve the deformation of the recording sheet **19** appropriately.

In the above-described illustrative embodiment, the recording sheet **19** may comprise a single downstream end area **91** and a single upstream end area **92** defined thereon with respect to the conveyance direction **16** as depicted in FIGS. **6**, **7**B, **7**D, **7**F, **7**H, and **12**A. Nevertheless, in a fourth variation of the illustrative embodiment, for example, a plurality of downstream end areas **91** and a plurality of upstream end areas **92** may be defined on the recording sheet **19** with respect to the conveyance direction **16**. For example, as depicted in FIGS. **8**B and **8**D, the downstream end area **91** of the recording sheet **19** may comprise a first downstream end area **91**A and a second downstream end area **91**B. Further, as depicted in FIGS. **8**F and **8**H, the upstream end area **92** of the recording sheet **19** may comprise a first upstream end area **92**A and a second upstream end area **92**B.

In the fourth variation, the first stop-control determination, the second stop-control determination, the first stop-control, and the second stop-control may be performed for each of the downstream end areas **91**A, **91**B and the upstream end areas **92**A, **92**B with respect to the conveyance direction **16**.

For example, the first stop-control determination in step S**50** and the first stop-control in step S**60** may be performed in both respective cases of a state where the conveyance of the recording sheet **19** is stopped in a state where the first downstream end area **91**A of the recording sheet **19** faces the nozzles **36** and the contact portions **83** (see FIGS. **8**A and **8**B) and a state where the conveyance of the recording sheet **19** is stopped in a state where the second downstream end area **91**B of the recording sheet **19** faces the nozzles **36** and the contact portions **83** (see FIGS. **8**C and **8**D). Further, for example, the first stop-control determination in step S**130** and the first stop-control in step S**140** may be performed in both respective cases of a state where the conveyance of the recording sheet **19** is stopped in a state where the first upstream end area **92**A of the recording sheet **19** faces the nozzles **36** and the contact portions **83** (see FIGS. **8**E and **8**F) and a case where the conveyance of the recording sheet **19** is stopped in a state where the second upstream end area **92**B of the recording sheet **19** faces the nozzles **36** and the contact portions **83** (FIGS. **8**G and **8**H).

In the fourth variation, the plurality of downstream end areas **91** and upstream end areas **92** (e.g., the first downstream end area **91**A, the second downstream end area **91**B, the first upstream end area **92**A, and the second upstream end area **92**B) defined with respect to the conveyance direction **16** may be an example of a plurality of end areas.

According to the fourth variation, the end area **90** may be divided into a plurality of conveyance-unit areas. Therefore, the deformation of the recording sheet **19** along the conveyance direction **16** may be relieved precisely.

In the above-described illustrative embodiment, all of the processing of steps S**610**-S**630** and steps S**710**-S**730** may be performed. Nevertheless, in a fifth variation of the illustrative embodiment, for example, the processing of one of steps S**610**-S**630** may be performed or the processing of two or more of steps S**610**-S**630** may be combined, and the processing of one of steps S**710**-S**730** may be performed or the processing of two or more of steps S**710**-S**730** may be combined. For example, only the processing of step S**610** of steps S**610**-S**630** may be performed and only the processing of step S**710** of steps S**710**-S**730** may be performed. In another example, the processing of steps S**610** and step S**630** of steps S**610**-S**630** may be performed and the processing of steps S**710** and S**720** of steps S**710**-S**730** may be performed.

In the above-described illustrative embodiment, in step S**620**, the maximum values in the ink amounts of the respective divided areas **93** constituting the downstream end area **91** and the upstream end area **92** may be compared with the predetermined maximum threshold value β**1**, respectively. In the above-described illustrative embodiment, in step S**720**, the maximum value in the ink amounts of the respective divided areas **93** constituting the downstream end area **91** may be compared with the predetermined maximum threshold value β**2**.

Nevertheless, in a sixth variation of the illustrative embodiment, for example, in step S**620**, each ink amount of each divided area **93** constituting the downstream end area **91** and the upstream end area **92** may be compared with the maximum threshold value β**1**. In step S**720**, each ink amount of each divided area **93** constituting the downstream end area **91** may be compared with the maximum threshold value β**2**.

When one or more (e.g., any one) of the ink amounts of the respective divided areas **93** is greater than the maximum threshold value β**1** (YES in step S**620**), the first stop-control may be performed. When all of the ink amounts of the respective divided areas **93** are smaller than or equal to the maximum threshold value β**1** (NO in step S**620**), the difference determination (step S**630**) may be performed.

When one or more (e.g., any one) of the ink amounts of the respective divided areas **93** is greater than the maximum threshold value β**2** (YES in step S**720**), the processing of steps S**210**-S**230** may be performed. When all of the ink amounts of the respective divided areas **93** are smaller than or equal to the maximum threshold value β**2** (NO in step S**720**), the difference determination (step S**730**) may be performed.

In the above-described illustrative embodiment, a single value may be specified in each of the maximum threshold values β**1**, β**2**. Nevertheless, in a seventh variation, the maximum threshold values β**1**, β**2** may be specified for every divided area **93**, and the maximum threshold values β**1**, β**2** for the endmost ones of the divided areas **93** with respect to the right-left direction **9** may be smaller than the maximum threshold values β**1**, β**2** for the other divided areas **93**.

For example, in FIG. **12**A, the maximum threshold values β**1**, β**2** for the endmost divided areas **93**A, **93**Q with respect to the right-left direction **9** may be specified smaller than the maximum threshold values β**1**, β**2** for the other divided areas **93**B-**93**P.

For example, in FIG. **12**C, both edges of the divided areas **93** other than the endmost divided areas **93** with respect to the right-left direction **9** may be allowed to be held by the respective corresponding contact portions **83**. On the other hand, both edges of the endmost divided areas **93** with respect to the right-left direction **9** might not be held by the respective contact portions **83** while its one edge located closer to a center of a recording sheet **19** than the other edge with respect to the right-left direction **9** is held by the corresponding contact portion **83**. Therefore, both end parts of the recording sheet **19** with respect to the right-left direction **9** may be deformed due to penetration of ink that may be less in amount than ink penetrating in the other part of the recording sheet **19**. Therefore, in the seventh variation, the maximum threshold values β**1**, β**2** for the endmost divided areas **93** that may tend to be deformed in the right-left direction **9** may be defined to be smaller than the maximum threshold values β**1**, β**2** for the other divided areas **93**. Thus, the deformation of the recording sheet **19** in the end parts thereof with respect to the right-left direction **9** may be relieved.

Although specific examples of carrying out the invention have been described, those skilled in the art will appreciate that there are numerous variations and permutations of the above-described systems and methods that are contained within the spirit and scope of the invention as set forth in the appended claims. Additionally, numerous other embodiments, modifications and variations within the scope and spirit of the appended claims will occur to persons of ordinary skill in the art from a review of this disclosure.

What is claimed is:

1. An inkjet recording apparatus, comprising:

a first conveyor configured to convey a sheet in a conveyance direction;

a support portion comprising a plurality of protrusions spaced apart from each other with respect to a width direction perpendicular to the conveyance direction, wherein the support portion is disposed downstream of the first conveyor with respect to the conveyance direction and configured to support the sheet from below;

a recording portion disposed opposingly above the support portion and configured to record an image onto the sheet supported by the support portion based on print data by ejecting ink droplets from nozzles;

a contact portion disposed between a pair of protrusions of the plurality of protrusions with respect to the width direction and in a manner that the contact portion faces the support portion, wherein the contact portion at least partially overlaps the plurality of protrusions when viewed along the width direction;

a control device; and

memory storing instructions that, when executed, cause the control device to:

determine, based on the print data, an amount of ink needed to form at least a portion of an image, corresponding to the print data, on the sheet;

determine whether to stop conveyance of the sheet, in a state where the sheet faces the contact portion, based on the determined amount of ink needed to form the at least a portion of the image; and

stop the conveyance of the sheet in response to determining that the conveyance of the sheet is to be stopped.

2. The inkjet recording apparatus to claim **1**, wherein the instructions stored in the memory, when executed, cause the control device to determine a number of droplets required to form the at least a portion of the image.

3. The inkjet recording apparatus according to claim **1**, wherein the at least a portion of the image is an image to be formed in an end area of the sheet with respect to the conveyance direction, wherein the end area extends from one of: an upstream edge of the sheet and a downstream edge of the sheet in the conveyance direction.

4. The inkjet recording apparatus according to claim **3**, further comprising:

a reverse guide portion defining a reverse conveyance path connected to a main conveyance path at a first position defined downstream of the support portion and at a second position defined upstream of the first conveyor with respect to the conveyance direction; and

a second conveyor disposed downstream of the first position with respect to the conveyance direction and configured to convey the sheet in the conveyance direction or in a direction toward the reverse conveyance path,

wherein the end area is an upstream end area extending from the upstream edge of the sheet,

wherein the sheet further includes a downstream end area extending from the downstream edge of the sheet, and

wherein the instructions, when executed, cause the control device to determine whether the conveyance of the sheet needs to be stopped in the state where the downstream end area of the sheet with respect to the conveyance direction faces the contact portion, based on the amount of ink needed to form the at least a portion of the image, wherein the at least a portion of the image is an image to be formed in the upstream end area of a second surface of the sheet opposite to a first surface of the sheet.

5. The inkjet recording apparatus according to claim **4**, wherein the contact portion is disposed upstream of the nozzles in the conveyance direction, and

wherein the instructions, when executed, cause the control device to determine, based on the determined amount of ink needed to form the at least a portion of the image, whether to stop the conveyance of the sheet, in the state where the downstream end area of the first surface of the sheet faces the contact portion, prior to ejecting ink onto the first surface of the sheet and after forming the at least a portion of the image in the upstream end area of the second surface of the sheet.

6. The inkjet recording apparatus according to claim **4**, wherein the instructions, when executed, cause the control device to determine whether to stop the conveyance of the sheet in a state where the downstream end area of the second surface of the sheet with respect to the conveyance direction faces the nozzles and the contact portion, based on the amount of ink needed to form the at least a portion of the image, wherein the at least a portion of the image is an image to be formed in the downstream end area of the second surface of the sheet with respect to the conveyance direction.

7. The inkjet recording apparatus according to claim **4**, wherein the instructions, when executed, cause the control device to determine whether to stop the conveyance of the sheet in a state where the downstream end area of the first surface of the sheet with respect to the conveyance direction faces the nozzles and the contact portion, based the amount of ink needed to form the at least a portion of the image, wherein the at least a portion of the image is an image to be formed in the downstream end area of the first surface of the sheet with respect to the conveyance direction.

8. The inkjet recording apparatus according to claim **4**, wherein the instructions, when executed, cause the control device to determine whether to stop the conveyance of the sheet in a state where the upstream end area of the second surface of the sheet with respect to the conveyance direction faces the nozzles and the contact portion, based on the amount of ink needed to form the at least a portion of the image, wherein the at least a portion of the image is an image to be formed in the upstream end area of the second surface of the sheet with respect to the conveyance direction.

9. The inkjet recording apparatus according to claim **4**, wherein the instructions, when executed, cause the control device to determine whether to stop the conveyance of the sheet in a state where the upstream end area of the first surface of the sheet with respect to the conveyance direction faces the nozzles and the contact portion, based on the amount of ink needed to form the at least a portion of the image, wherein the at least a portion of the image is an image to be formed in the upstream end area of the first surface of the sheet with respect to the conveyance direction.

10. The inkjet recording apparatus according to claim **3**, wherein the end area is an upstream end area extending from the upstream edge of the sheet,

wherein the sheet further includes a downstream end area extending from the downstream edge of the sheet, and

wherein the instructions, when executed, cause the control device to determine whether to stop the conveyance of the sheet in a state where a downstream end area of one surface of the sheet with respect to the conveyance direction faces the nozzles and the contact portion, based on the amount of ink needed to form the at least a portion of the image, wherein the at least a portion of the image is an image to be formed in the downstream end area of the one surface of the sheet.

11. The inkjet recording apparatus according to claim **10**, wherein the instructions, when executed, cause the control device to determine whether to stop the conveyance of the sheet in a state where the upstream end area of the one surface of the sheet with respect to the conveyance direction faces the nozzles and the contact portion, based on the amount of ink needed to form the at least a portion of the image, wherein the at least a portion of the image is an image to be formed in the upstream end area of the one surface of the sheet with respect to the conveyance direction.

12. The inkjet recording apparatus according to claim **10**, wherein the contact portion is disposed upstream of the nozzles in the conveyance direction.

13. The inkjet recording apparatus according to claim **1**, wherein the sheet includes an end area extending from one of: an upstream edge of the sheet and a downstream edge of the sheet in the conveyance direction,

wherein the end area of the sheet is divided into a plurality of divided areas in the width direction, and

wherein the instructions, when executed, cause the control device to determine whether to stop the conveyance of the sheet based on a respective amount of ink needed to form a respective image in each of the plurality of divided areas.

14. The inkjet recording apparatus according to claim **13**, wherein the instructions, when executed, cause the control device to determine to stop the conveyance of the sheet in response to determining that an average of the amounts of ink needed to form the images in the plurality of divided areas of the end area is greater than an average threshold value.

15. The inkjet recording apparatus according to claim **13**, wherein the instructions, when executed, cause the control device to determine to stop the conveyance of the sheet in response to determining that one of the amounts of ink needed is greater than a maximum threshold value.

16. The inkjet recording apparatus according to claim **15**, wherein a respective maximum threshold value is specified for each of the plurality of divided areas, and

each of the respective maximum threshold values for a first endmost divided area and a second endmost divided area, in the width direction, is smaller than the maximum threshold value for at least one divided area disposed between, in the width direction, the first and second endmost divided areas.

17. The inkjet recording apparatus according to claim **13**, wherein the instructions, when executed, cause the control device to determine to stop the conveyance of the sheet in response to determining that a difference in the amounts of ink needed for two adjoining divided areas of the plurality of divided areas is greater than an adjoining threshold value.

18. The inkjet recording apparatus according to claim **17**, wherein the inkjet recording apparatus comprises a plurality of contact portions disposed upstream of the nozzles with respect to the conveyance direction, wherein each of the plurality of contact portions disposed upstream of the nozzles is disposed between a different pair of protrusions of the plurality of protrusions with respect to the width direction, and

wherein the instructions, when executed, cause the control device to determine not to stop the conveyance of the sheet in response to determining that:

a difference in the amounts of ink needed for a divided area and a closest other divided area facing a respective contact portion is greater than a neighbor threshold value, or

a difference in the amounts of ink needed for a divided area and a closest other divided area facing a respective protrusion is greater than the neighbor threshold value.

19. The inkjet recording apparatus according to claim **13**, wherein one or more of the plurality of protrusions are disposed at a boundary between the plurality of divided areas.

20. The inkjet recording apparatus according to claim **13**, wherein the contact portion is disposed at a boundary between the plurality of divided areas.

21. The inkjet recording apparatus according to claim **13**, wherein the end area is divided into the plurality of divided areas with at least one boundary between the plurality of divided areas defined at a position between one of the plurality of protrusions and the contact portion with respect to the width direction.

22. The inkjet recording apparatus according to claim **1**, wherein the sheet includes an end area extending from one of: an upstream edge of the sheet and a downstream edge of the sheet in the conveyance direction,

wherein the sheet is divided into a plurality of divided areas in the conveying direction, and

wherein the instructions, when executed, cause the control device to determine whether to stop the conveyance of the sheet for each of the plurality of divided areas.

23. The inkjet recording apparatus according to claim **1**, wherein a lowest end of the contact portion is located lower than highest ends of the plurality of protrusions.

24. An inkjet recording apparatus, comprising:

a conveyor configured to convey a sheet in a conveyance direction along a conveyance path;

a support portion is disposed downstream of the conveyor with respect to the conveyance direction and configured to support from below the sheet being conveyed in the conveyance path;

a recording portion disposed opposingly above the support portion and configured to record an image onto the sheet supported by the support portion based on print data by ejecting ink droplets from nozzles;

a corrugate mechanism configured to form a corrugated shape in the sheet;

a control device; and

memory storing instructions that, when executed, cause the control device to:

determine, based on the print data, an amount of ink needed to form at least a portion of an image, corresponding to the print data, on the sheet;

determine whether to stop conveyance of the sheet, in a state where the sheet faces the corrugate mechanism, based on the determined amount of ink needed to form the at least a portion of the image; and

stop the conveyance of the sheet in response to determining that the conveyance of the sheet is to be stopped.

25. The inkjet recording apparatus according to claim **24**, wherein the corrugate mechanism includes a contact member comprising:

a fixing portion configured to be fixed to the inkjet recording apparatus;

a curved portion extending downwardly and in the conveyance direction from the fixing portion; and

a contact portion extending from the curved portion in the conveyance direction, the contact portion configured to contact the sheet.

26. An inkjet recording apparatus, comprising:

a first conveyor configured to convey a sheet in a conveyance direction;

a support portion comprising a plurality of protrusions spaced apart from each other with respect to a width direction perpendicular to the conveyance direction, wherein the support portion is disposed downstream of the first conveyor with respect to the conveyance direction and configured to support the sheet from below;

a recording portion disposed opposingly above the support portion and configured to record an image onto the sheet supported by the support portion based on print data by ejecting ink droplets from nozzles;

a contact portion disposed between a pair of protrusions of the plurality of protrusions with respect to a width direction and in a manner that the contact portion faces the support portion, wherein the contact portion at least partially overlaps the plurality of protrusions when viewed along the width direction;

a control device; and

memory storing instructions that, when executed, cause the control device to:

determine whether to stop conveyance of the sheet, in a state where the sheet faces the contact portion, based on the image to be recorded corresponding to the print data; and

stop the conveyance of the sheet in response to determining that the conveyance of the sheet is to be stopped.

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